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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PRIZE ESSAY, JANUARY 1, 1901.

NAVAL ADMINISTRATION AND ORGANIZATION.

Motto: The Country—The Service—The Individual.

By LIEUTENANT JOHN HOOD, U. S. Navy.

It is with considerable hesitation that the writer selects so broad and comprehensive a subject as Naval Administration and Organization for the theme of an essay; but existing conditions leave so much to be desired in both the administration and organization of the Navy that any honest effort for improvement, however imperfect, may do some good, and will at least do no harm.

The treatment of so extensive a subject in a limited space permits of only very general ideas being given, and very broad lines being drawn; and the remarks that follow are not offered as a structure complete in all its parts, but rather as a mere framework of suggestion to those who have the interests of the service at heart, in the hope that abler hands may take up the work and carry it to full completion.

As it stands to-day, the Navy could hardly be said to be more than an aggregation of individuals, without proper cohesion, or

unity of purpose. The elements are excellent in themselves, whether they be men or ships, but something more than an aggregation of them is needed to make the service the complete, harmonious, homogeneous whole that it should be, working with one purpose for the advancement and glory of the country. That is the final end for the attainment of which all lovers of the service should strive, and the remarks and suggestions that follow are a feeble effort in that direction.

The subject-matter selected for discussion will be taken up in the order of the two great heads of the title, and we will discuss first—

ADMINISTRATION.

Naval administration, to the mind of the writer, includes all things pertaining to the direction of the naval policy of the country; the organization of the Navy Department or central office of naval administration, and its apportionment into the proper divisions and subdivisions; the direction and control of the naval personnel; and the formation, direction and control of fleets.

Up to the present time it would be more than bold to say there has been any naval administration at all in the true sense of the term. Certainly there has been no fixed naval policy, nor any logical, consecutive system of development. As new needs have arisen from time to time, a new bureau or a new office has been created here and there, and grafted on the old system without any proper co-ordination, or logical plan for future development. The result has been a heterogeneous mass of old and new, without cohesion of parts or unity of design, and with frequent rivalries between parts where there should have been nothing but co-operation. The law of its growth has been the expediency of the moment, and reason, logic and foresight have had little or no part in its development. It may be said to exist only by the force of custom, and to attain any degree of efficiency only by the strength and character of many eminent bureau chiefs.

This spirit of following the law of expediency, rather than logical plan and system, permeates the entire naval establishment, but more especially its administration, and has done more to delay true naval growth than any other cause. It is founded on the moral weaknesses of some, the personal ambitions and jealousies of others, and the want of foresight and ideas of false

economy of all; and the sooner it is swept aside, and reason and logic substituted therefor, the better it will be for both the country and the service.

It may be accepted as an axiom that all creations—whether of the intellect or the hands—that are destined to live and bear good fruit are founded on reason and the natural order of things; and since we wish our naval administration to be a living force in itself, and not dependent entirely on the force and character of passing individuals, let us see if it is not possible to organize it on a natural and logical basis, to the end that naval development may be continuous and progressive, despite the short-comings and failures of any individual heads or chiefs.

It is a necessary consequence of our form of government that the official head of the Navy shall be a civilian who usually goes into office nonconversant with naval duties, customs and traditions. While this has its disadvantages, in that it frequently exposes questions of a purely technical nature to the decision of one necessarily ignorant of their bearings, it has the undoubtedly great advantage of supplying the Navy with a head free from the contamination of service cliques and corps, and of giving it an impartial arbitrator in service disagreements. In many ways it would tend much more to thorough efficiency if the head of the service knew and *felt* all its aims and needs, and were in full personal sympathy with it; but this same result can be attained, to a great extent, by the proper selection of his subordinates; and our system of placing a non-naval and military man at the head of the navy is, perhaps, the wisest that could be designed. However, whether it be wise or unwise, the system will always be followed as long as our government lasts, and further discussion of it is useless; and we will proceed to the consideration of what improvement may be accomplished under him.

As at present constituted, the affairs of the Navy Department are administered by a number of independent, or semi-independent, bureaus and offices, sometimes working together—though more through accident than design—but more frequently at odds, and with little or no military subordination and sequence or natural and logical groupings. If the matter be looked at broadly, from either a statesmanlike or a military point of view, the whole comprehensive subject of naval administration naturally and logically divides itself into two, and *only* two, great divi-

sions—1st, that of the personnel, and 2d, that of materiel. Therefore, logically and naturally, the affairs of the Navy should be administered under these two heads, and under these two only. For all division of responsibility beyond that required by reason and logic tends to weaken the responsibility and promote carelessness, diffusion and general inefficiency.

The Division of the Personnel should comprise all that relates to the naval personnel, its training, discipline and detail; all that relates to preparation and plans for war and action; all that relates to the direction and control of commissioned ships and fleets; or, generally, all that pertains to the Navy as a *military* and *fighting* organization.

The Division of Materiel should comprise all that relates to the design, construction, equipment and maintenance of ships, ordnance, machinery, yards, docks, etc.; or, generally, everything that pertains to the creation and maintenance "in being" of the most efficient and largest fleet allowed by the laws.

Just as naturally as the whole administrative system divides itself into these two great heads, these divide themselves into certain subdivisions, that will be discussed under their appropriate heads.

Personnel.

Taking the divisions in the order of their importance, we will consider first the personnel. This division should have for its chief an officer who would be the true *military* head of the Navy. He should be carefully selected from the highest grade of the line, and, as Chief of Personnel, should be the ranking officer of the Navy. He should be the chief adviser of the Secretary in all matters of naval policy, and should direct and be responsible for all the matters above enumerated as comprising the Division of Personnel.

No one thing has done more to foster laxity of discipline, develop insubordination, and check the growth of a proper military spirit and "esprit de corps" than the want of this military head; and until such is established all hope of thorough reform and of moulding the Navy into as perfect a fighting machine as human nature permits is vain.

Heretofore the duties of a semi-military head have been performed by the Chief of Bureau of Navigation; but his scope has

been far too limited, and his position too anomalous to accomplish much good—in a military sense. What is needed is a genuine military head, recognized by the law and by the service as such; and such a head should be the Chief of Personnel.

For the administration of naval affairs relating to personnel, the Division of Personnel should be composed of the following branches or subdivisions:

(1) *The General Staff.*—This most important of the subdivisions of personnel is yet all to be formed, except such small parts of its duties and functions as have heretofore been performed by the War College and Office of Naval Intelligence. From the nature of the requirements of a general staff, its formation in completed perfection can only be an accomplishment of time. Hence its development should be begun at once.

The official and legal recognition of a general staff and the selection of a proper chief, with a limited corps of assistants, and with the Office of Naval Intelligence and the War College placed under him, would be a long step in the right direction.

The Chief of the General Staff should be next in rank in the personnel branch of the service to the Chief of Personnel, and should occupy towards that chief the same position that the latter does to the Secretary. He should be the chief adviser of, and replace the Chief of Personnel in case of absence, sickness or temporary disability.

(2) *Bureau of Naval Organization and of Detail.*—This bureau should have charge of the organization of ships' complements, of squadrons and fleets, of all drills and systems of military instruction, of keeping the records of all officers and men in the naval service, and of the detail of all officers and men to ships and stations for the utilization of the varying talents of all to the best interests of the service.

Perhaps there is no subject connected with naval administration that requires more tact and fine judgment than the detailing of officers and men to fill the positions for which they are best fitted, and for the best interests of the government; and there is none that has usually received less attention, especially in the lower grades. Our present system requires all men to be all things, and attempts to eliminate human nature from the most human of all problems—the control and handling of men. It would be difficult to find an officer of 20 years' experience who

has not at some time in his career sailed with an executive officer who could not execute, a navigator who could not navigate, and a watch officer who could neither control the crew nor handle the ship. Each of these officers may have been excellent on some other line of duty; but the system required that he should fill a position for which he was unfitted, to the loss of discipline and efficiency, or the hazarding of the lives of a ship's company and the safety of the ship. The duties of the Navy are so varied that there is room for talent of all kinds, and the "detail" duty of this bureau should be one that receives the most careful consideration, and the personal supervision of its chief.

(3) *The Office of Naval and Military Law and Discipline.*—This office should have cognizance of all matters pertaining to the administration of law and justice in the Navy, and the enforcement of discipline under the laws. It is essentially a branch of the personnel, and should therefore be placed under the direction of its chief. The head of the office should be known as the Judge Advocate General, and should be chosen from the active officers of the Navy well versed in military law, and in close touch with naval customs and the needs of naval discipline. This close touch with naval customs and needs being as essential to the efficient administration of naval justice and discipline as a knowledge of the law; the term of office of the Judge Advocate General should never exceed eight years, and would be better limited to four.

One of the first duties of this office should be the preparation, for submission to Congress, of a new code of laws for the administration of justice in minor offences, the clearer separation of minor and grave offenses, and the general simplification of the administration of law as conducted in the Navy to-day. The necessity for this simplification, and of the proper classification of offenses and punishments by law is at the present time one of the most urgent needs of the Navy for the maintenance of discipline.

(4) *The Hydrographic Office.*—This office, as now, should have charge of the collection and dissemination of nautical information of all kinds; and the preparation of the charts, books, etc., needed for the proper navigation of the active fleet in all parts of the world. The work of this office is purely professional, and has no connection whatever with the materiel of ships. Therefore

it is difficult to see why it should be placed under an essentially materiel branch of the service, as at present, when logically it should come under the control of the division that would naturally apportion and direct its work.

MATÉRIEL.

Before taking up the detail discussion of this great division of the Navy, it might be well to preface it with some general remarks on the advisability of its consolidation.

As the department is at present organized, the affairs of the materiel of the Navy are administered, under the Secretary, by a number of equal, co-ordinate, independent heads, frequently disagreeing among themselves from that ineradicable trait in human nature that causes almost every individual to magnify the importance of the part of any joint work designed by himself. These disagreements—most usually on technical questions, and arising from honest differences of opinion—must be referred for decision to the Secretary, who, however great his ability, has rarely the technical education and training that would fit him to decide them to the best advantage.

The parts of a modern ship are so various, and involve so many distinct professions, that many minds are necessarily engaged in evolving the finished vessel. The constructor, the engineer, the ordnance officer, have each and all been necessary to form the completed whole, and many compromises have been made between them from the inception of the plan to the time the finished ship is ready for service. That in the adjustment of these compromises many disagreements should arise is only human; and, in the opinion of the writer, their settlement, and the general building of the Navy, would be much facilitated if there were a common head to all the branches engaged in work on materiel with sufficient technical knowledge and experience of ships to decide the question intelligently, and with sufficient authority to settle them. Not only would the work be much facilitated, but the Secretary would be relieved from a most onerous duty, and one that he must have frequently felt himself unqualified to fill.

Although men of the high attainments, broad technical knowledge and administrative ability necessary to fill successfully the responsible position this head must occupy are not common in any profession, there are, and always will be, a rare few in the

Navy, as there are in all other great professions; and from these few the head or chief of materiel should be chosen. It is the same type of men that are found filling the positions of general managers and superintendents of all the great industrial enterprises of civil life.

Though a chief of specialists, he need not be a specialist himself; but must be, however, a man of extensive mechanical ability, and of broad experience of ships *at sea* under all conditions of service; and, above all, of great executive ability.

He should by law be the officer next in rank in the Navy to the Chief of Personnel, and should be the chief adviser of the Secretary in all matters relating to the creation and maintenance of fleets, and should have control and direction of all navy yards and repair stations.

Consolidated under his authority, instead of being the independent co-ordinate powers they are to-day, should be the following subdivisions:

(1) *The Bureau of Construction.*—This bureau should have cognizance of all the affairs of materiel relating to the design, construction and repair of ships, docks and stations, and should have the care of all navy yards and repair stations. Its chief and assistants should be constructors and constructing engineers of the highest type obtainable; and the chief should bear the same relation to the chief of matériel that that chief bears to the Secretary.

The present bureau of yards and docks, and the system that has heretofore prevailed of laying out and designing our navy yards and stations under many heads would seem to be illogical, and has certainly led to much unnecessary expense and confusion. The placing of the whole navy-yard system under the one head that controls the great bulk of the work done in them, would seem to be reasonable, and would undoubtedly lead to economy, efficiency, and to the adoption of a systematic plan in the arrangement of shops and buildings.

(2) *The Bureau of Engineering.*—This bureau should comprise everything relating to the design, construction and management of all machinery in the Navy, both ashore and afloat, except that relating to ordnance. Its chief and assistants should be mechanical engineers of the highest order; and, to be such, can be nothing else.

(3) *The Bureau of Ordnance.*—This bureau should have cognizance of the design, building and care of all ordnance, ordnance material and appliances, and of all armor used in the Navy; and have control of all naval gun foundries and proving grounds.

The handling and management of naval guns and all their appurtenances being distinctly among the primary duties of the line, the chief and assistants of this bureau should be chosen from that branch of the service from among those who have made a specialty of ordnance matters by natural predilection.

Moreover, excellence in design and construction can only be attained by the application of the intimate knowledge and experience gained in the actual use of the guns and their appliances in all the varying conditions of active service. This knowledge and experience can only be obtained at sea; and, therefore, the ordnance expert must be also a sea-going officer, and should never be segregated from the sea-going line into a distinct and individual corps.

(4) *The Bureau of Equipment.*—This bureau should control the fitting and arrangement of the entire equipment of vessels, except that of ordnance and machinery.

The chief and assistants of this bureau should be taken from the line of the Navy, as full knowledge of the necessities of ship equipment can only be acquired by those who actually go to sea in ships, and learn from daily experience, in the varying conditions of sea life, what is actually needed for thorough efficiency.

In addition to the subdivisions enumerated above, the administration of the Navy requires two other important branches which are not so logically classible as being wholly of either the personnel or materiel as those already mentioned; and are yet not of the primary importance that requires the establishment of separate and independent divisions in the administration for the proper conduct of their administrative duties. These two branches comprise the duties now administered by the bureaus of medicine and surgery, and of supplies and accounts.

While the peculiar duties of these two branches render them both more or less independent of the natural classification of all the other branches, they are both of a subordinate character, and are adjuncts rather than primary powers in the administration. Therefore, it would seem more logical and in the right order of things to class them under the one or the other of the

two great divisions with which they are the more nearly assimilated than to form two more divisions of the first order in the administration for two essentially subordinate branches.

The duties of the surgical branch of the Navy bring it in close alliance with the personnel; and, therefore, it would seem logical to class that branch with the personnel, and the bureau of medicine and surgery as the 5th subdivision of personnel. It should be organized, as at the present time, except that it should act through the military head of the Navy instead of as an independent power.

On the other hand, the pay branch of the Navy in the purchase, transportation, and care of all the material of the Navy is, in its administrative duties, far more closely allied with the materiel; and hence the bureau of supplies and accounts should be classed as the 5th subdivision of that great division in the organization of the administration.

No other branches of the naval administration than those indicated above are either necessary or logical; and the division into the two—and only two—great divisions of the personnel and materiel would seem to be so natural and conducive to efficiency and unity of action, that the administration must have long since been formed on these lines but for the continued reign of the law of expediency, and the influences of personal ambitions and of politics.

The suggested organization of the naval administration then is:

1st. The head, the Secretary of the Navy.

2d. The Division of Personnel, whose chief would be the *military* head of the naval service, and who would be the chief adviser of the Secretary in matters of naval policy, and in all matters affecting the Navy as a military entity.

3d. The Division of Materiel, whose chief would be the chief adviser of the Secretary in all matters relating to the construction and maintenance of fleets, yards, docks and stations.

For the consideration of questions of naval policy of a wider and more deliberate nature, the chief of personnel, the chief of the general staff, the chief of the bureau of detail and organization, and their principal assistants, should form a permanent board on policy and naval strategy, under the presidency of the chief of personnel, for the assistance of the Secretary in creating and formulating the naval plans of the nation.

For the assistance of the Secretary in formulating plans for the creation and maintenance of the fleet, for deciding the types and sizes of ships, their armaments, speed, etc.; or, generally, everything connected with putting "in being" the most efficient fleet possible, the chief of materiel, chief constructor, chief of engineering, chief of ordnance, and chief of equipment should form a permanent board on construction, under the presidency of the chief of materiel, who should have the deciding voice.

The Secretary would thus, at all times, have at his disposal the experience and advice of the chiefs of the two great divisions of the naval administration; and in matters of graver import requiring further deliberation and discussion, could convene either the board of policy and strategy, or the board of construction—or both—according to the nature of the question.

In general, the Secretary should hold the chiefs of the two great divisions responsible for the proper performance of all matters relating to their respective divisions; and leave them to hold their subordinates to a like responsibility; for responsibility, properly carried, is the sure test of efficiency. It can be properly carried only when it proceeds from the head down, for in any efficient organization the head is *always* responsible.

It would be impossible to develop a complete scheme of naval administration in the narrow limits of an essay, and this branch of the subject matter of the title will be closed with the few broad suggestions offered above, for the majority of which no claim to originality is made. But it would seem that an administration organized and developed on the lines suggested would be following the laws of logic and reason, would prove efficient, lead to unity of purpose, develop the best in all branches, and promote a spirit of emulation and military "esprit de corps."

Organization.

Naval organization, like administration, naturally and logically divides itself into the same two great divisions—1st, that of the personnel, and 2d, that of the materiel.

Of these two, the first only will be treated at any length here. Given the ships—and Congress is giving them with a liberal hand—their proper organization into fleets and squadrons to meet any emergency is a simple matter. Plans will have already been prepared to meet any foreseen emergency by the proposed

general staff and board of naval policy and strategy. Any changes required by unforeseen variations in the emergencies can be easily and quickly accomplished by any master mind. But the proper organization of the personnel is a matter of slow development and education; and while a genius may perform prodigies with the faultiest of organizations, geniuses are rare, and the organization should be such that a leader of even ordinary ability can at least commit no grave faults.

The right and proper organization of the personnel is the vital and living question of the Navy to-day, and will be for all time. The tendency of our law-makers, as also of many of the more technically minded of our own body, is to forget the supreme importance of the *personal* side of all questions of naval efficiency, and to either ignore it, or, when forced to take note of it, make the vain attempt to eliminate human nature and capabilities from the problem. A ship, as a fighting machine, is always just as efficient as its officers and crew, and not one jot more, however perfect it may be in structure and design; and the finest battleship ever built, without a complement, is as worthless for fighting purposes as the veriest hulk in rotten row.

It would be well if these simple truths were borne in mind in the framing of laws, as well as in the making of details and complements in the Navy itself. For in all cases of action of any kind—and the Navy is solely and only designed for action—the *human* element is the far most important of all that enter, and should receive the consideration its importance demands.

The recent attempt to reorganize the personnel of the Navy by the passage of the law commonly known as the " Personnel Act " was, to the mind of the writer, a distinct step backwards, and against both logic and the spirit of the age. At a time when science in all its branches is advancing with such rapid strides, and when perfection and thoroughness in any profession requires the full and entire effort of even a superior mind, and when specialism is the watchword to eminence and success in all professions, to practically abolish one of the most absolutely necessary and most highly specialistic branches of a modern naval service would seem to be contrary to all reason and the teachings of experience. The composite substitute offered of a class of officers alternating from line to engineer may work efficiently in some future development of the human mind, but in

its present state will surely lead to disaster sooner or later. Taking the Navy as a whole, it would be difficult to select a more excellent class of material than that of which its officers are composed; but each individual, be he by nature a line officer or an engineer, requires all the powers of his intellect to be proficient in his own branch; and it is a rare genius who can be thoroughly efficient in the many requirements of both.

Neither the passage of a law nor the giving of a title makes the line officer, the engineer or the constructor. It is only years of hard work, study and training that make any of them; and while the rare genius mentioned above who can combine them all in his capacious brain may occasionally appear, a service like ours is not composed of such, and it would be the part of wisdom to accept human nature as it is and frame laws for men as we find them, and not for exceptions that may appear at long intervals.

Therefore, it would appear to be the plainest and simplest conclusion of logic that the practical abolition of the engineer corps of the Navy was a mistake, and cannot be rectified too soon for the good of the service. The present system will run for a time, for we have still in the service a number of trained engineers of the old system under another title. But in a few years these will be laid aside, and there will be none to take their places; for it is only too evident, even now, that the younger officers of the line, designed by the law to supply the need, do not as a class wish to, nor could many of them do it efficiently if they did, and still maintain proficiency in their own legitimate profession. The final result of the system continued is plainly apparent; inefficiently designed and cared for machinery, break-downs, delays and general inefficiency of the service as a fighting machine.

It is the firm conviction of the writer, founded on much thought and some study and experience, that the efficiency of the Navy absolutely requires the establishment of a corps of naval engineers who shall be engineers of the highest order obtainable, and nothing else, if we wish not only to keep our place with the advancing navies of the world, but if we wish to prevent ourselves from falling hopelessly behind, and meeting with disaster in the first great trial. If the present system be continued, sad experience and the logic of events will themselves re-establish this corps sooner or later; and that such experience

may be avoided and time not wasted, it would be wise to start the re-establishment as soon as possible.

On the other hand, this corps when re-established should be almost as far removed from the corps as advocated by many of the supporters of the old system as from the present system of nondescripts. Engineers of the highest order of training and education are needed on board ship; but large numbers of them are as little needed as would be a dozen Edisons to put up an electric bell wire. Any one would laugh at another for using a hundred ton derrick to hoist a hundred weight, when small cranes were plentiful and convenient; yet the system advocated by the enthusiasts of the old engineer corps is practically the same thing. There is room in the very limited space on ship-board for only what is necessary, and this room is too valuable and too much needed for other purposes to be wasted in quarters for unneeded officers.

But the need of the very highest class of engineers on board ship, in the numbers corresponding to the duties to be performed, is more crying now than at any time in the previous history of the Navy; and that need will become more and more urgent as the Navy expands, and machinery and mechanical devices increase and multiply. And while it will be absurd to use highly trained and educated designing and constructing engineers for engine drivers, one or more—according to the size of the ship and intricacy of the machinery—should be on all ships of the Navy as directors and superintendents of machinery, and should be held responsible for the proper working and efficiency of all machinery and mechanical devices in the vessel.

For this purpose, one is sufficient for gunboats and smaller cruisers, two for cruisers of the second class, and three for cruisers of the first class and battleships. Any greater number of engineers of the highest class on board ship is superfluous, and therefore useless. For the engineering work under them, the present system of warrant machinists, and machinists of the various classes, supplies just the order of material needed for the work to be performed.

This subject of the necessity for engineers on board ship and of the kind required has been entered into somewhat more fully than the length of this paper warrants; but the writer believes so firmly that in this lies the weakest point of our present naval

system, and that it will sooner or later lead to disaster if not corrected, that space has been sacrificed in the endeavor to bring out what he believes to be right views in as strong and convincing a light as possible.

Returning now to naval organization in general, the chief requirements for a proper and efficient organization are:

1. The organization should be such as to promote and encourage a true military spirit and emulation, maintain the "esprit de corps" of all branches of the service, and enforce discipline.

2. It should consist of all the branches necessary to the command, creation and maintenance of modern fleets, and no others; and should define the co-relation of these branches clearly.

3. It should be homogeneous, and, as far as possible, all branches should be drawn from the same source, to the end that there may be a feeling of kinship between all branches, and that all may start with a military training, and with some unity of feeling and mutual sympathy.

4. There should be a proper co-relation of numbers in the various grades of all corps, and provision made for a flow of promotion, that the age and rank of each grade may correspond with the duties of the grade. And there should also be provision made for expansion to meet the requirements of an increasing Navy.

In the first of the great requisites enumerated, the Navy has been much lacking, as far back as the knowledge of the writer extends. This is due to the lack of a proper military head to the Navy more than to any other cause; and the establishment of one in the person of the chief of personnel—as suggested in the discussion on administration—will do much to correct the evil. It has also been much fostered by the want of a true military system in the issuance of orders and filling of details, availability having generally been the guide rather than "good of the service."

The establishment of such a military head, and the following of a system founded on military efficiency by the suggested Bureau of Detail and Organization, would go far towards correcting all the defects of the present organization, and would tend much to promote a spirit of emulation and pride of service necessary to true naval efficiency and proper subordination.

The creation of this spirit would not be accomplished all at

once. The spirit of independence, bordering on insubordination, is too deeply rooted in the service, and is too much a part of the original birthright and nature of our people to be eradicated at a word of command. But the training should be begun immediately, and the reform should start at the top, as should all reforms.

In regard to the second requisite laid down, it will have been already observed that the writer is no great believer in the universal genius of man, and is firmly convinced that the best work is generally accomplished by men who devote their whole time and intellect to one profession.

Therefore he believes that the good of the service requires a separate corps for each great profession included in it and necessary to it.

These corps are:

1. The Line.
2. The Corps of Surgeons.
3. The Corps of Constructors.
4. The Corps of Engineers.
5. The Corps of Paymasters and Commissaries.
6. The Corps of Chaplains.

These corps, and no others, are necessary to a complete, logical naval organization.

The present corps of professors of mathematics is a relic of a dead system, and is an unnecessary adjunct to the Navy, and should be allowed to die out by no more appointments being made to it.

The present corps of civil engineers is an anomaly in a naval establishment filled with engineering skill, and its members should be joined as an adjunct to construction,—which latter branch should have charge of the maintenance of yards, docks and stations,—and no further appointments to the corps made. In the future the construction corps should contain its engineering experts to do the duties now performed by civil engineers, just as the line contains to-day its ordnance experts, and for very much the same reasons.

The co-relations of the various corps have already been indicated in the discussion on administration, except those touching the corps of chaplains, and these need no explanation.

In discussing the third of the requisites laid down above, it

may be well to recall to mind a few of the commonest and most every-day traits of human nature. The impressions, feelings and sympathies of youth are the most vivid and lasting of life. The bonds of sympathy and fellow-feeling that last throughout life between men of a common Alma Mater are well known. It is equally well known that, with few exceptions, the true military feeling and instinct is never imbibed in mature life; and that the average man who has failed to have military training in his youth may wear epaulettes for half a lifetime with little more of genuine military spirit at the end than when he began, and chafes at the necessary restraints of military life, to the detriment of discipline always. These traits and feelings come out even more strongly in a naval service, where men are thrown so closely together as on shipboard, than in a military service on shore.

Since human nature is thus, and since unity of purpose combined with love and comprehension of the whole service, and a true military spirit, are so necessary in adjusting the many conflicting interests that arise in the building and fitting of ships, and the conduct of naval affairs, it would be well to take advantage of these traits, and to organize the Navy in the manner most calculated to make the best use of them. Such unity of feeling, comprehension of military necessities, and sympathy and understanding between branches can only obtain when all have received the same military training, and have imbibed their impressions and knowledge at the same source.

For these reasons, all branches of the naval service, with the exception of the surgeons and chaplains—who form distinct non-combatant classes—should be drawn from the Naval Academy; and Congress should make provision for a sufficient number of cadets to supply all needs.

In the apportionment of the cadets into corps, after two years training in common, the individual cadet should be allowed a certain latitude in selection, though the final decision should rest with the Academic Board. Then each branch should be trained and educated in its own profession. The candidates for the pay corps, whose profession requires little technical training beyond the development of natural business aptitudes, should take the line course, and be trained to be capable of commanding men on board ship in case of need. The course of the candidates for the construction corps should be considerably extended in

the mathematical and engineering branches, and a school of construction founded as a component part of the Academy.

In this way, and in this way only, can a homogeneous naval personnel be established; and though each branch follows its own profession, all have a military training, and all have a common feeling of sympathy and fellowship, that brings with it a comprehension of the needs, aims and ambitions of the others.

The selection of a standard as a basis for discussion is necessary for consideration of the fourth and most comprehensive of the requisites laid down. We have now completed 7 first-class battleships, 2 armored cruisers, and a number of vessels of lesser importance. We have under construction—or authorized—10 more first-class battleships, 6 armored cruisers and a number of lesser cruisers, monitors, gunboats, destroyers, and torpedo-boats. The completion of the ships under construction, and already authorized, will considerably more than double the fighting efficiency of the Navy as it exists to-day, as regards materiel, and will give us a fleet of 17 first-class battleships, 8 armored cruisers, 1 second-class battleship, and a large number of lesser cruisers, large and small, with monitors, gunboats, destroyers, torpedo-boats and auxiliaries numbering 214 in all, not counting obsolete monitors, receiving ships and state school ships. This expansion of the materiel bids fair to continue as the country itself grows and expands, and each succeeding Congress adds to the splendid roll already borne on the list of ships.

While this vast expansion of the fleet has been, and continues to be, so liberally provided for by our lawmakers, *nothing* has been done to meet the corresponding increase demanded in personnel. If this blind policy is to be pursued, it would be much better to save the money of the people, cease building and trust to Providence for our defense. It takes years to make a battleship, but it takes more years still to make a naval officer; and the former is worse than useless without the latter, in that its being gives a false hope of protection and security that will lead to worse disaster than an acknowledged lack of all protection. Therefore, it would be wise, if we are to continue the increase of the fleet, to at least start the increase of personnel with it.

But this is a matter that rests with Congress, and so a useless discussion for the purposes of this paper; and we will return to the point in question, of the selection of a standard, and the organization of the grades of the Navy to fit the standard.

As the fleet already provided for enumerated above will be exceeded in a very few years, let us take for our standard fleet in commission, for the purposes of our argument, a fleet of:

20 battleships.
10 cruisers of the 1st class.
20 cruisers of the 2d class.
20 small cruisers.
40 gunboats.
20 destroyers.
20 torpedo-boats.

It will be observed that the list includes only sea-going and fighting ships proper, and does not include auxiliaries of any kind; for the handling of colliers, supply-ships, etc., has never appeared to the writer to be the legitimate duties of a naval officer, and would seem to be a reversal of the old adage of the silk purse and the sow's ear. The whole transport system, however, should be under the control of the Navy Department, and should so sensible and logical a change ever be made the lists given below should be increased by the number of officers required for that service.

In the following enumeration of officers required for the ships of the various classes, only the *least* number possible for anything approaching battle efficiency will be given, and many of them, especially the battleships and large cruisers, should have more to contend on equal terms with the ships of their classes in other navies.

A battleship or cruiser of the 1st class should carry 1 captain, 2 lieut.-commanders, 5 lieutenants and 8 lieutenants (junior grade) and ensigns, or 16 commissioned officers of the line. 1 chief engineer, 2 assistants, 2 surgeons, and 1 paymaster, or 6 commissioned officers of the staff. In addition to these, they should carry 2 gunners, 1 boatswain, 1 carpenter, and at least 5 warrant machinists, or 9 warrant officers. This makes a total of 22 commissioned officers and 9 warrant officers, or 31 officers of all kinds.

A cruiser of the second class should carry 1 captain, 2 lieut.-commanders, 3 lieutenants, 2 lieutenants (junior grade) and 5 ensigns, or 13 commissioned officers of the line. 1 chief engineer, 1 assistant, 2 surgeons, and 1 paymaster, or 5 commissioned officers of the staff. In addition they should have 1 gun-

ner, 1 boatswain, 1 carpenter and 4 warrant machinists, or 7 warrant officers, making a total of 18 commissioned officers and 7 warrant officers, or 25 officers of all kinds.

A small cruiser should carry 1 commander, 1 lieut.-commander, 3 lieutenants, 2 lieutenants (junior grade) and 3 ensigns, or 10 commissioned officers of the line. 1 engineer, 1 surgeon, and 1 paymaster, or 3 commissioned officers of the staff. In addition they should have 1 gunner, 1 boatswain and 4 warrant machinists, or 6 warrant officers, making a total of 13 commissioned officers and 6 warrant officers, or 19 officers of all kinds.

A gunboat of the 1st class should carry 1 commander, 1 lieutenant, and 3 lieutenants (junior grade) or ensigns, or 5 commissioned officers of the line. 1 engineer, 1 surgeon, and 1 paymaster, or 3 commissioned officers of the staff. In addition it should have 3 warrant machinists, making a total of 8 commissioned officers, and 3 warrant officers, or 11 officers of all kinds.

A small gunboat or a destroyer should carry 1 lieutenant, 1 lieutenant (junior grade) and 2 ensigns, or 4 commissioned officers of the line.

A torpedo-boat should carry 1 lieutenant and 1 ensign, or 2 commissioned officers of the line.

Therefore, to maintain a fleet of the size selected as the standard in commission, in anything approaching battle efficiency, would require for actual sea service:

	Capts.	Comdrs.	Lt. Comdrs.	Lieuts.	Lt. (J. G.)	Ensigns.	Totals.
[illegible]	[illegible]	60	120	350	270	410	1260
[illegible]			30	50	70	40	190
[illegible]			50	50	60		160
[illegible]			30	40	20	20	110

[illegible] do not include the necessary flag officers, or [illegible] staffs, but simply include the officers [illegible] individual ships.

[illegible] that in the above table no staff officers [illegible] commander are included in the officers [illegible] ships. And with the exception of the [illegible], this is as it should be; for there is no [illegible] complement of a single ship for a [illegible]

[illegible] actually at sea, a number will always be

required on shore in the naval administration, and at the various yards and stations, if we wish our ships armed, equipped and fitted to the best perfection. For it may be taken for granted that men with years of daily experience in the use and handling of all things pertaining to ships in actual service, are far more competent to superintend their armaments and fittings than any other class could be. Moreover, since they are destined to use and command the ships themselves, and their very lives and honor depend on the perfection of the preparation, they have a personal interest in this preparation being thorough that no one else can feel. Therefore, to determine the total number of officers required to maintain our standard fleet in commission, those who perform this class of duty must be considered, as well as those actually at sea; for preparation is little less important than action.

In establishing the ratio of the number of officers required on shore to those at sea, it is well to divide the Navy list into two classes: the "command" and advisory class, and the "working" class. The first would include all on the active list of and above the rank of commander; the second all of and below the rank of lieut.-commander. From the nature of the administrative and directory duties pertaining to the functions of the Navy on shore, the proportion of the "command" class required for these duties would be much greater than of the "working" class; and in the "working" class itself, the proportion should diminish as we go down the list, and the last grade of ensign should be a sea-going grade pure and simple.

As previously indicated, in the staff corps, except the number required for fleet staffs, *all* the "command" class should be on shore, where their duties naturally lie.

On July 1st, 1900—as shown by the official Navy Register—of the entire sea-going force of the line of the Navy, from the admiral to the lowest ensign inclusive, 67⅛ per cent were actually on ships. Dividing the same list into the "command" and "working" classes, there were 40⅓ per cent of the "command" class on ships, and a small fraction under 74 per cent of the "working" class. The remaining 26 per cent of the "working" class included not only those on shore duty proper, but those on shore duty on foreign stations, and all on sick leave and in hospitals.

With the present number on the Navy list, the percentage of the "command" class on shore is not unduly large; but as the Navy increases there will be but few more officers of those grades required for the shore duties than at present, and the *percentage* at sea with a larger list should be greater. The number of important posts on shore requiring flag officers, however, will always be considerably greater than the fleets in commission, and the present proportion of admirals afloat and ashore will not vary materially. There should be at the least 5 afloat, 6 in the administration, 6 in command of the six important stations, 2 for heads of boards, and at least one more for contingencies, or 20 in all.

For captains and commanders, the percentage at sea, with an increased list, should never be less than 50 per cent. This would require for the complete maintenance of the standard fleet under consideration a total of 100 captains and 120 commanders afloat and ashore.

Coming now to the "working" class, it is difficult to see how less than the present percentage of about 25 per cent for the numerous and multifarious duties on shore can be spared without grave detriment to the service. For it must always be borne in mind that the preparation of the tool is only less important than the skill in handling it, and only those who know and understand all its uses can prepare it properly and successfully.

But, naturally, the 25 per cent of the "working" class required for shore duty would be taken more from its higher and more experienced grades, while the lowest grade need have only surplus enough to allow for rest, sickness and waste. This could hardly be put at less than 10 per cent; and a good distribution for the other grades would be about 15 per cent for lieutenants (junior grade), 25 per cent for lieutenants, and 35 per cent for lieut.-commanders.

Therefore, to equip, fit, arm and keep in commission the standard fleet under discussion, requiring actually at sea—exclusive of flag officers and staffs—50 captains, 60 commanders, 120 lieut.-commanders, 350 lieutenants, 270 lieutenants (junior grade) and 410 ensigns, would require a total line force of 20 admirals, 100 captains, 120 commanders, 184 lieut.-commanders, 467 lieutenants, 318 lieutenants (junior grade) and 456 ensigns.

The duties of the engineer and medical corps being propor-

tionally more of a shore nature than those of the line (especially in the "command" class, which should be practically all on shore), a larger percentage of their sea-going classes are required on shore. There should be in both corps, above actual sea requirements, at least 40 per cent in the lieut.-commander grade, 30 per cent in the lieutenant grade, 25 per cent in the lieutenant (junior grade) grade, and, in the engineer corps, 20 per cent in the ensign grade.

This would put the "working" class of the engineer corps necessary for our standard fleet, at 50 of the rank of lieut.-commander, 71 of the rank of lieutenant, 88 of the rank of lieutenant (junior grade), and 48 of the rank of ensign. To this should be added the proportionate numbers in the grades of the "command" class for the higher duties on shore and for fleet staffs, or 1 chief of the corps, with the rank of rear-admiral, 15 chief engineers with the rank of captain, and 25 with the rank of commander.

In the same way, the corps of surgeons would be 1 surgeon-general with the rank of rear-admiral, 15 medical directors with the rank of captain, 25 medical inspectors with the rank of commander, 82 surgeons with the rank of lieut.-commander, 71 surgeons with the rank of lieutenant, and 75 assistants with the rank of lieutenant (junior grade).

In regard to the pay corps, the duties of the "command" class are almost exclusively shore duties, as in case of surgeons and engineers. In the sea-going "working" class, the number required afloat will average about double those required on shore; and therefore about 33⅓ per cent above sea requirements should be provided in this class. Hence the pay corps of the standard fleet would call for 45 paymasters, rank of lieut.-commander, 60 paymasters, rank of lieutenant, 30 assistants, rank of lieutenant (junior grade), and 30 assistants with the rank of ensign. To these should be added the proportionate number in the higher grades, or 1 paymaster-general, rank of rear-admiral, 15 pay directors, rank of captain, and 20 pay inspectors, rank of commander.

Thus, to efficiently maintain in fighting condition the standard fleet that has been selected for discussion, the Navy Register should contain the following numbers of officers of the various corps and grades:

	R. Adml.	Capts.	Comdrs.	Lt. Comdrs.	Lieuts.	Lt. (J. G.)	Ensigns.	Total.
Line	20	100	120	184	467	318	456	1665
Engineers ..	1	15	25	50	71	88	48	298
Surgeons ..	1	15	25	82	71	75		269
Paymrs. ...	1	15	20	45	60	30	30	201

In the table just given the numbers in the various grades of all corps are proportioned to the duties to be performed for what may be called a 20-battleship organization; and as the Navy increases beyond this, the same relative proportions of grades should hold, so that provision for expansion to meet future requirements could be easily made.

It will be noticed that in the battleship and first-class cruiser classes, one commissioned officer is required for about every 500 tons of displacement. In the gunboat and destroyer classes, one is required for about every 100 tons of displacement. As the number of small vessels is necessarily much greater than of large ones, the average displacement in the composite fleet, per commissioned officer, is about 225 tons. Therefore, to meet the needs of a growing service, it would be a simple matter, in drawing the law organizing the naval personnel, to authorize an increase of one commissioned officer for every 225 tons of displacement provided for, over and above any tonnage worn out and laid aside in the same period, the increase to be distributed throughout the Navy list, so as to preserve the relative proportions of the grades as given in the above table.

Something of the number of warrant officers required has already been indicated in some of the foregoing lines; but space does not permit of entering into the details of this branch of the service, nor of the non-sea-going construction corps, though any complete scheme of organization should include all branches of the service.

The space limit fixed for himself by the writer has already been considerably exceeded; but even the briefest discussion of naval organization would be manifestly incomplete without some suggestions in regard to the maintenance of a continuous flow of promotion, and the regulation of the service to make the duty fit the age and rank of the officer.

Anyone with 20 years of service experience can recall to mind frequent incidents where somewhat elderly gentlemen were per-

forming the duties of youth, and young men those of boys. Many other incidents can be recalled where a too long training in subordination without responsibility had unfitted the officer for the active responsibilities of command when that grade was finally reached; and it is no infrequent occurrence to find most excellent subordinate officers in the service deprived by their training of all the independent initiative necessary for efficient offensive action in time of war.

There are, of course, some men whom no vitiating systems or circumstances can crush, and the Navy happily possesses many of these. But the majority of naval officers belong to the average of mankind, on whom training, custom and habit exert an overpowering influence. Therefore, the organization should be such that the training in command and responsibility should begin before youth and ambition are dead; and a system that puts a premium on mediocrity and teaches men to obey well but command ill cannot be abandoned too soon.

The only remedy for this—perhaps the greatest evil under which the Navy suffers to-day—is to organize the personnel in such a way that the age of each grade fits its duties.

To accomplish a reform so sweeping, and one that will affect the private interests of every individual in the service, one way or another, will be exceedingly difficult; but with one so necessary, private interests should not be allowed to stand in the way, and "the good of the service" alone should be the guiding spirit of both the Navy and the law-makers.

Some attempt was made to grapple with this evil in one of the few living clauses of the "Navy Personnel Act," establishing a reasonable flow of promotion. But the reform did not go deep enough to reach the root of the evil. The one and only way to eradicate it forever is to establish an age limit in grade, for the fitting of age to rank and duty. An ensign over 25, a junior lieutenant over 30, a lieutenant over 40, a lieut.-commander over 45, a commander over 50 are all anomalies when any thought whatever is given to the duties of the grades.

In accomplishing so sweeping a reform as is here advocated, and especially in view of the condition into which the Navy list has been allowed to drift in the course of years, through no fault of the individuals borne thereon, all the consideration possible, consistent with "the good of the service," should be given to

those individuals; and it would be well to extend the accomplishment of the reform over a limited number of years. But this period should not extend beyond five years at the most, and with a reasonable increase in personnel, so loudly called for by the enormous increase already authorized in materiel, and reasonable retirement laws, the reform could be accomplished almost immediately with injustice to few, if any, of those now borne on the Navy list.

The writer knows full well that this proposition, to establish an age limit in grades, is almost as old as the Navy itself, and that he has stated nothing new in his remarks. But the question will recur again and again as long as the Navy lasts, or until it is incorporated in our system as the only logical and reasonable solution of the present and past most unsatisfactory conditions.

One other proposition almost as old and quite as hackneyed, yet equally important, that should undoubtedly be incorporated in any system of naval organization, is the promotion to flag rank by selection. This has been fought over so often that little new can be said on the subject, yet a few remarks will be attempted.

Speaking on this subject some years ago with an English post-captain, whose chances of further promotion had passed, the writer asked the captain if he felt no bitterness and discontent at being thus passed by. The answer of the English captain was a model that did credit to himself and to the system under which he had been trained, and his spirit might well be emulated in our own service. He said, "No. Naturally, I would have loved to have been promoted, but there were *better men*, and *it is all for the good of the service.*"

The reply of this English captain would seem to condense the whole matter in a nutshell. If there are *better men* "the good of the service" requires that they shall be selected. As a matter of fact, in case of war this is what is always done, without giving the officer selected the actual rank and position on the Navy list to which the responsibilities and duties to which he is called justly entitle him. This is manifestly unjust to the officer concerned and to the whole service. It places him often in equivocal positions in connection with officers his seniors on the Navy list, and leaves it to his personality to produce the results that should

flow from actual rank. Few will be found bold enough to maintain that all men are born natural commanders-in-chief. Yet that is the assumption on which our system is founded; and when the necessities of war compel a departure from so illogical a system the work and responsibilities are carried by the selected few, and the rank and rewards go to all. As a matter of reason, of logic, or of justice, the argument is unanswerable that to those who do the work and carry the responsibility should come the rank and the rewards. Yet our system is contrary to all this, and takes from every individual in the service one of the greatest of human incentives to strive for the attainment of excellence.

The reason of the Navy's being is war, and war only; and a system that will not stand the test of war should be swept aside forever. Admirals are designed primarily to command fleets in time of war, and no one has a right to that proud title whom the Department would hesitate for an instant to send to sea in command of a fleet to meet the enemy.

Undoubtedly, by any system of selection that would be adopted, some errors and injustice to individuals would be unavoidable, however fair-minded the selectors might strive to be. But almost any system, however faulty, would produce better results, on the whole, than the present plan; and the experience of both the war of the Rebellion and the late Spanish war would seem to prove that selection, handicapped as it was by the present laws, was eminently successful.

Let our motto be, the country first, the service next, and the individual last, and reforms will adjust themselves, and the service become as near its design as human nature permits.

DISCUSSION.

Captain F. E. CHADWICK, U. S. N.—I wish first to thank Lieutenant Hood for a most thoughtful, able and philosophic paper. It is a subject over which I have addled my own brains sufficiently to know its difficulties, and to enable me to know something of the study and labor of which this is the evidence. The organization of administration has always been a weak point in our system, and it has been weakest where, by the complex nature of the subject, it should be strongest—in the navy. Nothing could be more haphazard, disconnected, and, so to speak, off-hand, than the law establishing our present organization. Within this law, by the one saving clause enabling the secretary to

establish the distribution of business, we have been slowly working towards some of the views which Lieutenant Hood advances. We thus finally have a Bureau of Personnel in our now misnamed Bureau of Navigation, which is wholly a military bureau; a startling instance of the slowness with which we move, as it has taken us more than a hundred years to arrive there; we have yet to take the next great step.

I agree, in the main, most cordially with the author's views. In a paper I wrote on the subject and published in the PROCEEDINGS OF THE NAVAL INSTITUTE, I took somewhat similar ground, but have seen reason since to alter some of my views, but I would say that this alteration has been almost wholly in the direction of those now expressed by the author. I think, however, that the head of the personnel should be also chief of the general staff; Mr. Hood subordinates the latter to this head, so that it works out somewhat the same, but I think it better that there should be no separation.

In 1894 I advocated a separate chief of staff, but I expressly stated my change of view on this subject in a letter to the department in 1899. I think the genius of our race demands fewer divisions of responsibility. Such a separation will work in Germany or France but not in America or England. The latter country has certainly evolved a most admirable working system and in this the head of the office of personnel is practically chief of the general staff and the military head of the service. Of course, in the system advocated, the head of the personnel should be relieved of much of the minor labor now devolving upon him; but that is a mere question of detail.

I think the assistant secretary should be the coördinator of bureaus of material advocated in the paper. The coördination could be arranged for either by his acting as the correlator directly of all the bureaus of material (including supply and works) or by having an intervening official to bring together the threads of the Bureaus of Ordnance, Construction, Steam Engineering and Equipment, and the other bureaus mentioned to have more direct relations with the assistant secretary. If the burden of work were not too great, it might possibly perhaps be better to dispense with the intermediate official over the four special technical bureaus, on the general principle of making responsibility as direct as possible; the question is too large to determine otherwise than by trial.

It must be remembered that intimately combined with all this is the navy yard administration; the questions of purchase, responsibility, distribution and account of stores and material, are all matters of great importance and of a difficulty which can hardly be exaggerated. If a new organization were to be, it would perhaps be best to begin with the fewest wheels possible and add as necessity demands. We have, on these points, the English service with its colossal mine of experience to which I would again hark back as an exemplar to be closely studied and followed as much as may be in filling out the details of the system which Lieutenant Hood has broadly and so ably sketched.

I cannot enter upon the subject of the second part of Mr. Hood's paper

to any great extent except to say that I think his views are, in the main, sound, except that I must say that I do not think we are in a position to dogmatize about the engineer. The exact relation of the engineer officer to the rest of the ship's hierarchy, in case of a separate corps of commissioned officers, must be recognized as a most difficult problem. The present arrangement undoubtedly solves much. I have always contended that the same man who was good enough to stand the engine-room watches, say in the Campania, is good enough to stand the watches in our own engine-rooms. But there must be immediately over these and the large body of men connected with the engineering force, a directive authority of a higher type and of a much higher rank for disciplinary and general directive purposes. It remains to be seen how our present arrangement will work. I am inclined to think it will adjust itself. It is a great experiment, which, if successful, will give us the immense advantage of greater homogeneity. Where there are 200 men to be looked after in a military organization, rank is a necessity. It carries a weight and influence which ages of experience have shown to be part and parcel of mere official position. Our American life rather causes us, in a general way, to rebel at the idea; but there are certain entities and fixities which are common to all mankind, and of which we cannot rid ourselves any more than we can of our race temperament, and the power which rank carries is one of these; I believe that any well-trained naval officer should be capable of this general direction.

While mentioning the subject of rank, I would say that I hope the day will come when we may recognize another fact, that is, that with perfect propriety and without derogation from the dignity of rank, the same rank may have many titles; that a captain or a medical director in the navy and a colonel in the army are equally well thought of and rank in the same plane despite their dissimilarity of titles. Title is one thing, rank is another; and while rank is of fundamental importance, title is only a matter of convenience. I hope that by the time Mr. Hood shall be successful in his reorganization our country shall be thoroughly imbued with the wholesome and self-respecting habit of thought which shall cause any public officer to insist upon being known for what he is and never for what he is not.

Captain CASPAR F. GOODRICH, U. S. N.—The essayist is quite right when he says that "there has been no fixed naval policy, nor any logical, consecutive system of development," but I am not sure that he is equally right when he describes the present "spirit of following the law of expediency" as "founded on the moral weaknesses of some, the personal ambitions and jealousies of others, and the want of foresight and ideas of false economy of all." Some measure of truth there may be in this indictment. The influences he cites are, however, essentially human, and they must be expected to exist in any human undertaking, to a less or a greater degree, according to the skill and wisdom of its designers. If these influences were made apparent under the essayists' analysis, he could certainly do no less than point them out and, at the

same time, indicate a means to their elimination. When things human are beyond improvement, they have already become divine. It will always be a healthy sign that members of the naval service seek for better things.

Personally, I am disposed to attribute our lack of a naval policy to our still more notable lack of a national policy. Without the latter it were idle to expect the former. Out of the nebulousness of the past there seems to be gradually shaping itself a scheme of national development affecting naval affairs in their turn and demanding the adoption of the best and most economical methods in order to achieve the desired results. The time is ripe for discussing the subject which the essayist states that he has selected, but which, I fancy, is less a choice on his part than forced upon him by his interest in and study of his profession.

An old officer once said to me that the bureau system was not so bad in itself, but that the Navy Department needed some office, or officer or commission, to knock together the heads of the bureau chiefs and make them agree. This idea would appear to have been in the essayist's mind as he wrote. The bureaus were originally intended to divide the navy's civil business among them and so relieve the secretary of much of the burden of his financial and other responsibilities. To-day, the bureau chiefs are so overwhelmed with the minutiæ of their several charges that they can not properly give sufficient time to the consideration of those broad questions which concern the service as a whole. The essayist's plan may not meet with universal acceptance, but it offers at least a well-reasoned means of reaching an end which is generally conceded to be greatly needed. It can not, therefore, be lightly rejected except by those who propose something in its place which shall be evidently and distinctly better. Much that he desires can be accomplished without legislation. I should suppose that the secretary would welcome a method by which he could secure unprejudiced and responsible advice from capable and chosen officers on matters of policy, types of ships, naval wants, etc. Of the General Board much was expected and by it much may have been accomplished, but a smaller body of advisers, composed of officers stationed at the department and meeting frequently, if not daily, would yield good fruit in continuity of thought and purpose, as well as in acting as a balance-wheel upon undue zeal or self-centered projects. The essayist provides, in a manner, for such a commission in his "Boards on Policy and Naval Strategy" and in his "Permanent Board on Construction." His proposition is, however, open to the serious criticism, as I view it, of combining in one set of men the unrelated, if not mutually antagonistic, functions of counsel and execution.

On the other hand, to combine all that concerns the personnel under one head and all that concerns the material under another head must commend itself to the judgment. For that feature of this essay I have only praise to offer.

Much of the difficulty now experienced in designing ships, for example, and the regrettable multitude of widely different patterns all bearing the

same label, would be avoided by committing to his Board on Policy and Naval Strategy (or, as I should prefer, a separate body of counsellors) the responsibility for general characteristics—types, in short—leaving the details to be worked out by the Board on Construction.

What a ship should be is a purely tactical question and should be settled by tactical experts. How to achieve this result is the province of the designer. Once the leading traits of the proposed new vessel are fixed, the essayist's plan of combining all the various branches of construction, engineering, ordnance and equipment under one control would work satisfactorily, promptly and economically to an extent which we can neither doubt nor foresee.

The essayist's proposition, in creating a division of material to abolish the bureau of yards and docks, is so manifestly business-like as to demand little passing comment, and to challenge no serious adverse criticism.

Possibly the essayist is correct in his strictures on the "Personnel Act," but I think it only fair to hold our judgment in suspense until more facts and a wider experience have been gained. Should time develop the evils which he prophesies, the establishment of a corps of real engineers of the highest possible attainments and efficiency would be in order. I have always been of the opinion that there is a broad, natural and impassable gulf dividing the naval engineer and the marine engine-driver, as I have always deprecated the use of the razor to do the work of the broad axe.

What the essayist says of the corps of professors of mathematics and that of civil engineers admits of little or no contradiction. In the minds of many, it is an open question whether even our constructors should form a commissioned corps in the navy, believing that the navy should contain no officers who do not go to sea. I mention this fact, not to raise a new issue, but to show that the essayist is not so radical as he might have been.

The paramount necessity of drawing upon the Naval Academy for all officers, except chaplains and surgeons, is well stated. But why should the paymasters be a separate corps? Why not detail officers from the line for this purpose?

As the number of ships in his standard fleet is a mere preliminary assumption necessary to determine the total number of officers required, I offer no comment beyond recording a doubt as to the readiness of Congress to provide so large a personnel. After all, it is ratios which are sought rather than concrete numbers.

Eventually, of course, we must come to an "age for grade" retirement. It does no harm to return again and again to this point, but such a measure must be accompanied by selection in the lower grades, otherwise men who enter the Naval Academy at the upper limit of age could never hope to reach command rank. If they possess the requisite ability, they should have a chance to pull ahead.

The proposition to introduce selection to the grade of rear admiral will find little favor in the service at large. The English system, which

he quotes, is far better, in that it selects only so far as the list of captains. But, as Kipling says, "That is another story." Strictly speaking, the matter of promotion is not germane to the subject of the essay. There is neither time nor space to deal with so vast a topic in the essay or in this brief discussion.

It will be perceived from what I have said, that, in the main, I agree with the views of the essayist, our only important difference lying in my doubt as to the desirability of placing upon certain administrative officers the further and contradictory responsibility of counsel.

In conclusion, I can not refrain from speaking of the happy, forcible and excellent style which crowns this admirable essay with unusual and notable literary merit.

Commander RICHARD WAINWRIGHT, U. S. Navy.—The essayist certainly has selected a broad and comprehensive subject, and one on which there may be many differing opinions. To my mind he has treated the subject in a masterly manner, and his essay must assist in strengthening the influence of the Naval Institute.

From the fact that the navy has been expanding rapidly and constantly, it may be inferred that there is necessarily a want of crystallization of methods, and that much is a mere adaptation of means to ends. One rarely sees a logical, consecutive system of development in human affairs. Certainly our railroads, our great factories, our navy, present no such system of development. What was logical in one stage of development may have become illogical in another, when further knowledge brings more light on the subject.

That we have been fairly successful in comparison with other navies must be admitted, and it seems reasonable to look for something besides the ability of the administrators, something within the organization, to account for this success.

With all its faults the bureau system has been successful, and to my mind the living cause of this success is the frequent change in the chiefs of bureaus. Coming fresh from the general service to administrative duty, a chief must know the needs of the service and must realize that what he creates to-day he may use to-morrow, and that he must benefit or suffer by the regulations he puts in force.

The most serious fault of the present bureau system is that it permits some chiefs to remain too long in office and thus gives undue influence to some branches. A man-of-war is a mass of compromises, and a chief of bureau can only reach the highest possible efficiency in his branch by strongly urging his own portion of the work. While to have one head of all the bureaus would save some contention before the secretary, yet this new chief must harmonize the efforts of his subordinates.

The principal faults in the present bureau system to my mind arise from the manner in which the appropriations are made, and is manifested largely in the conduct of our navy yards and in the purchase of supplies. The commandants of our yards should be the actual heads of the establishments and not, as now, the moderators or nominal heads

of a number of subheads, representatives of the different bureaus. The money for the maintenance of the navy should be appropriated in a lump sum and allotted to the navy yards for specific work, not distributed among the various bureaus. This is too large a subject to more than mention in a criticism.

My principal objection to a chief of material is that once in four years, he would become a permanent head and he would lose the great advantage of close contact with service interests.

A chief of personnel is a good idea; it rounds out and strengthens the duties of the present Chief of Bureau of Navigation; but he should be the chief of the general staff.

While the office of the Judge Advocate General should be placed under the chief of personnel, many of the present duties of the Judge Advocate General should be removed from his office and placed under the assistant secretary, such as all matters of contracts and points of law not purely military.

I disagree entirely with the writer's remarks on the Personnel Bill. It is "plainly apparent" to me that the few men that have heretofore designed our machinery were not made by our old system, but in spite of it. To me the "logic of events" that have passed predicts success for the future. The men who have designed steam engines, turret and electric machinery of all kinds, are all engineers. I cannot see why engineering should stop at the entrance to the turret-chamber or to the dynamo room. Designing engineers will be selected without difficulty from the large body of the new line, who will have about the same early training as the old engineers, and will have almost as much experience with machines, and who will not have their intellect dulled by standing cold iron watches or making tidal observations in the bilge.

The increase of officers as urged by the essayist is most important to the navy, and as the only reasonable way to obtain this increase is through the Naval Academy, additional appointments to that institution should be urged upon Congress. It will be necessary to dispel the growing impression that the Naval Academy is an aristocratic institution, and to point out the fact that it is the most democratic institution in the world, admitting boys from all classes and making scholarship and aptitude the only criterion for standing in the service. Certainly learning is not the usual badge of aristocracy, and it has never been democratic to reward ignorance with high rank.

Professor P. R. ALGER, U. S. N.—I think that, in the long run, the essayist's plan of interposing a "chief of material" between the Secretary of the Navy and the Bureaus of Construction, Engineering, Ordnance, Equipment, and Supplies and Accounts, would do more harm than good. The present "Board on Construction" is a very efficient instrument, and the frequent disagreements of its members are always in regard to matters properly open to a difference of opinion and the discussion of which is desirable. If it were possible, which it never will be while there

as a Secretary of the Navy, to give to a single officer the deciding voice in all questions regarding material, disputed points might possibly be sooner decided than they now are, but only at the expense of less careful consideration. The Secretary of the Navy had far better accept the finding of a majority of the Board on Construction than allow any individual to set aside their opinion, and especially so since a divided board can always be augmented by other officers when matters of great importance are to be decided.

I am still more strongly in disagreement with Lieutenant Hood in his condemnation of the amalgamation of the line and engineer corps. If the "general inefficiency" which he predicts as a result of our present system ever comes, it will, in my opinion, be because that system has not been fairly and honestly tried. Lieutenant Hood says that the younger officers of the line do not as a class wish to take the places of the trained engineers of the old system. But in accordance with his own views, with which I entirely agree, only a limited number of highly trained engineers is needed, so that the younger line officers "as a class" are not required to become trained engineers in the sense in which he uses that expression.

He admits that the line produces its ordnance experts; why cannot it produce its engineering experts? Is it because steam engineering is less agreeable work than ordnance or electrical engineering that Lieutenant Hood fears we shall soon have no specialists left in the former field? Unless he forsakes his own avowed principles, and approves of the sacrifice of the good of the service to individual preferences, he should demand that officers who can become experts in steam engineering be made to devote themselves to that line of work.

Setting aside the moral qualities which are the first essential for a good naval officer, I think that no one can doubt that to be a competent engineer, using the word in a broad sense, is more necessary than anything else for efficient service as a subordinate on a modern man-of-war. If the propelling machinery of a battleship be put on one side, and all her other machinery of every kind on the other, I venture to assert that more engineering knowledge is needed for the proper care and handling of the latter than of the former. If the average line officer is enough of an engineer to have full charge of the torpedoes, ordnance appliances and electric installation, it will require little added engineering knowledge for him to also take charge of the propelling machinery. If, however, it be contended that we need specialists for ordnance, etc., then why should not specialists for steam engineering be developed in the same way out of the line? If line officers are as anxious to become specialists in steam engineering as in ordnance or electrical engineering, then there will be no difficulty in getting a sufficient supply of the former. It should be recognized that until an officer reaches the grade of lieutenant-commander, there is no other one thing so important as that he shall be a thoroughly competent practical engineer, and though steam engineering may be less agreeable to him than some other branches, he must sacrifice his individual feelings to the good of the service.

It is perhaps natural that I should be unwilling to accept Lieutenant Hood's mere dictum that "the present corps of professors of mathematics is a relic of a dead system and is an unnecessary adjunct of the navy." Surely there is some room for argument on this subject. I suppose Lieutenant Hood would favor withdrawing the Naval Observatory from naval control, but if this were done the most important sphere of duty for professors of mathematics would still remain. In my opinion, the heads of all the non-professional departments at the Naval Academy should be permanent, not shifting every two years or so, and the corps of professors of mathematics affords a means of filling these positions with commissioned officers specially selected with a view to their capabilities. The army has its "corps of professors at West Point," ranking with lieutenant-colonel and colonel, and filling the positions of heads of departments, and the navy can, in my judgment, get good service from its corresponding corps of professors of mathematics and should not willingly acquiesce in its abolishment. Do not condemn the instrument because in some hands it has been badly used.

As regards Lieutenant Hood's proposed age for grade limits, it is to be noted that a radical change in the standards of admission to the Naval Academy would be entailed thereby. At present a graduate may be 26 years of age and a considerable number would be retired under Lieutenant Hood's plan before ever being commissioned officers. Even were the upper limit of age of admission to the academy placed where the lower limit now is, at 15 years, making the age of final graduation 21, the requirement that promotion to the grade of junior lieutenant must occur before the age of 25 would make it necessary to provide 114 vacancies each year above the grade of ensign, and this would mean at least 60 compulsory retirements annually. I think it would be much better to only have retiring ages fixed at the two points of promotion to commander and to rear admiral.

Lieutenant S. S. Wood U. S. N.—I take pleasure in seconding the opinion of the Board of Control in deciding that the paper of Lieutenant Hood is worthy of a prize and in assuring him of my hearty approval of his scheme of naval administration and organization. I wish that it might be brought before every officer in the service, and that each would give it the careful thought to which it is entitled, and I feel sure that were it adopted *in toto* the service at large would be much benefited. The scheme in general is excellent, but perhaps some difficulties would be met with in carrying out the details. Still, I cannot believe that they would prove to be insurmountable if undertaken with a sincere desire for the betterment of the service.

May I touch on a few of these details, not in their order of importance perhaps, but in the order in which they are presented in the essay?

I think the division into the Personnel and Materiel as made by the essayist extremely good, but is it really very different from what is now in vogue? Now, the different bureau chiefs report to and confer directly with the secretary; by the new scheme, they would report to

their immediate chief and the secretary instead of having eight advisers to listen to would have only two. Surely the secretary would not object to this; but, would not these two advisers be tempted to call into conference with the secretary the subchief who had gone into the subject more deeply than he had done? I think so, and, as soon as we increase the number of minds to decide upon a certain thing, are we not increasing the labor and, therefore, delaying the progress of the work? Unless each chief has in his own division almost as much authority as the Secretary of the Navy has now, I fear that the transaction of business will not be more rapid than at present.

It seems to me that the two chiefs proposed should hold their offices for four years at least, even if this should carry them beyond the retiring age. I do not advocate that this should be usually practiced, or, if allowed, that it should stop the flow of promotion until the incumbent passes to the retired list. No; let him remain on the active list, but let the others move up as if he had taken his place with those who had retired at the age of 62. The point I am endeavoring to bring out is the advisability, nay, the necessity, of having the chiefs in their positions long enough to shape a policy and prove its utility. If, as the essayist suggests, only those from the highest grade are available for this duty, will we not have an ever-changing chief to look up to? And with these changes will not the service suffer? I think so.

We Americans are inclined to scoff at the conservatism of the English, but does it not seem as if each new chief, like a true American, in his desire to improve existing conditions, introduced too many changes for the good of the system? Would it not be well for us if there were a law which required that every regulation or order issued for the guidance of the service should remain in force for a year or more unless it could be proved that its enforcement inflicted positive injury to individuals or great loss to the Government? It is undoubtedly a good thing to be able to change existing orders, but if it were known that when once issued they must stand long enough to be securely tested would not more care be exercised in promulgating them?

As to the necessity of having an engineer corps in the navy there never has been any question in my mind. They may be given line titles, but their duties must still be performed and well performed, too, or our ships soon become useless and broken down. Surely the practice which has proved economical and advantageous in the merchant service could be applied with even more force to our modern ship of war. Let our highly educated officers superintend and be ready for an emergency, but let the engine-drivers perform the daily and hourly watch duty. Thus from knowing the actual needs of the ship at sea will he become better able to design the machinery for others.

By all means make this division before the cadet leaves the Naval Academy; make no distinction other than ability and aptitude, and then proceed to develop along the lines chosen for them by the Academic Board.

I am heartily in accord with Lieutenant Hood in his remarks about

the necessity of having all branches of the service, with the exception of the surgeons and chaplains, drawn from the Naval Academy. Much of the severe criticism often heard in the ward-room upon the acts of the commanding officer would thus be avoided; for many, by their course at the academy, would learn the first principles of military discipline, and knowing them while young, might carry it out by their example and teaching later in life. Of course there will always be growling, but the wholesale condemnation of orders, acts or decisions of superior officers should never be permitted.

I am also ready to place myself on record as being in favor of promotion to flag rank by selection. There are abundant arguments in favor, and the few opposed to it ought not to be allowed to stand in the way of the good of the service.

We can only perfect our service by a hearty cooperation of all of its members, each one striving to do his best; and surely this is a favorable opportunity to try and learn the opinion of the members on this fundamental thing—its organization and administration. I wish that the Institute could get an expression of opinion from every officer of the service, and then perhaps we would be willing to abide by the decision of the majority.

I desire in closing to thank the essayist for the excellent thoughts which he has suggested and to express a wish that his plan will some day be adopted and carried into effect.

Lieutenant L. H. CHANDLER, U. S. N.—In reading this most excellent essay I find myself in hearty accord with the essayist's views as far as the question of administration is concerned, and I believe that such an arrangement as he describes would, in general, prove an ideal one.

There are, however, one or two points in that part of the essay which treats of organization upon which I desire to touch.

The first of these is the judgment passed by the essayist on the working of the present system of organization of the line of the navy as created by the Personnel Bill of 1899. This bill amalgamated the old line and engineer corps, and against this one particular feature much adverse criticism has recently been launched, in many cases by those who favored the amalgamation at the time the bill was under discussion. The claim against the amalgamation is that it has taken away from us our corps of trained engineers and given us nothing in its place.

By the amalgamation, as provided by the Personnel Bill, two things were to be accomplished, the first being to bring together into one new corps all living officers of the two old corps, and the second, to educate for the future a class of officers who would be able to do the duties of both corps. Only to a very limited extent was it intended to transform the old engineer into a line officer except in cases where the youth of the said officer was supposed to render it possible. All this is ancient history to every one, but I have repeated it here merely to give point to the remarks that follow:

There are in the navy to-day exactly the same number of the old

engineer officers that would have been to-day in the old engineer corps had it continued to exist, and out of this number there are one lieutenant-commander, twenty-eight lieutenants, thirty lieutenants of the junior grade and eleven ensigns, a total of seventy in all (Navy Register, January 1, 1901), who are, from choice or by law, doing line duty to qualify themselves for duty in the new line. In other words, the Personnel Bill has resulted in the temporary withdrawal from engineering duty of but seventy of the old engineer officers. I say temporary, because after they qualify for the line, these officers will take engineering duty in the same proportion that other line officers should.

The question arises at once as to why these seventy engineer officers have not been replaced by other competent officers of the line, if indeed they have really not been so replaced. Is it because seventy officers of the old line competent to do daily routine engineering duty aboard ships with simple machinery could not be found? I deny that this is the case, and I do not believe the essayist will claim that it is. In fact, a considerable number of old line officers have been so ordered as engineers and have performed their duties with ability.

The truth of the matter is that at the time of the passage of the Personnel Bill the navy had just been enormously enlarged, and it has remained so enlarged ever since. Had the Personnel Bill never been passed, we should to-day have exactly the same outcry for more engineer officers that we have under the present system, and the need would be just as great. The demand for more line officers is to-day just as great, if not greater, than that for more engineers, and it would be just as correct to charge the present shortage of line officers caused by the expansion of the navy to the workings of the Personnel Bill because some officers of the old line have been given engineering duties, as it is to charge upon that measure the present strong need for engineer officers caused by the same enlargement because seventy engineers are now performing line duty.

In other words, I deny that the amalgamation has reduced the number of competent engineer officers available, and assert that the present cry for more engineers is caused exclusively by the same reasons that have brought about the present great scarcity of sea-going officers of both branches.

The law never was intended to make a man who was already only an engineer into a line officer, or vice versa, merely by its enactment, and nobody ever claimed that it would do so, yet to-day it is judged, and most unjustly so, by its failure to do that very thing. A certain number of old line officers are learning to be engineers, and a certain number of old engineers are learning to be line officers, and if there are not enough men available in each branch, as there are not, the shortages are due only to the small total number of officers of the new line available, and not to the shifting of duties. The department has at its disposal to-day a certain number of line officers available, and in assigning them to duty a certain proportion go to each branch of the service. Because the actual number thereof assigned to engineering is not enough the Per-

sonnel Bill is blamed, but in my opinion the chief of the Bureau of Ordnance might as justly claim that, because he is short of inspectors and has to leave important work to civilian subinspectors, who have in many cases proved incompetent, therefore he ought to be given a separate corps of officers to do his work, and his work only. I am confident that, could we get a sufficiently great total number of officers in the line of the navy so that each branch of work could have a proper number of units assigned to it, then the shifting of these units from one branch to the other according to their adaptability would become a comparatively easy matter, and we would find the now ever-increasing complaints against the amalgamation feature of the Personnel Bill dying away to nothing.

I believe that this would be true even with the present officers, who have not been specially brought up to meet the conditions of to-day were there only enough of them. I have confidence enough in the ability of my brother officers to believe that in that case, while each man could not become thoroughly expert in every branch, still, when an expert was needed in any particular subject, it would not be difficult to lay hands on him. It is hardly more difficult now to find an *expert* for a particular duty than it is to find *anyone, expert or not.* As well condemn the present system because every man in the line is not competent to do the design work for the Bureau of Ordnance, as because everyone is not a competent designing engineer.

Being possessed of the abiding faith above set forth, that if the total were only large enough the subdivisions would arrange themselves, even when the total is made up of officers raised under the old system, I am still more confident that, by the time the officers of the navy are all men who have been educated for the present conditions, the new line as a whole would be most thoroughly and efficiently competent to perform all the duties, line and engineering, that would by right to it belong. There would still be the occasional square peg in the round hole, of course, as will occur under any system, but with a large number of pegs and holes to manipulate, the necessity for putting the two misfits together would be less likely to occur than under the old system.

Again, again, and *again,* the crying need of the navy is for more graduates from the Naval Academy each year! Let every man bestir himself to bring about an increase in the number of appointments to the Naval Academy, and when success has been attained to a sufficient degree to give the total that is needed, the evils of amalgamation will never be heard of again.

Having said my say in regard to the criticism by the essayist of the amalgamation feature of the Personnel Bill, I will state what I believe to be the proper organization of the line, following as much as possible Lieutenant Hood's method of expression.

I would have a line of sufficient total numbers, not as to-day, with one thousand men to fill two thousand places. No system can make one man into two. This, of course, Congress must be induced to provide, and as long as it is not so provided no system will produce good results.

Then each line officer should be aided by the department as much as possible in developing his particular faculties in certain directions. A man who proves himself a thoroughly competent engineer, ordnance officer, electrician, torpedo officer, etc., by passing appropriate *rigid practical* examinations, not such as come before promotion, should be so designated in the Navy Register. Then, aboard ship and ashore, the officers who are fit for certain duties should be given them to perform, regardless of their rank, that fetich that says that number three on the list of a ship's officers shall run the dynamos whether he can do it or not.

Every officer who graduates from the Naval Academy can, as far as human nature renders it possible to make such a statement, learn to perform the daily duties of the turret, deck and engine-room equally well, and can give satisfaction in the performance of them all. In so doing the younger officer will find himself naturally attracted in a particular direction, and a desire to be known as a qualified specialist will, in nine cases out of ten, lead him to become expert in one or even more of the special branches without losing general efficiency thereby. The tenth man who feels no special interest in anything is the man who should be used to stimulate promotion by prompt action on the part of the examining board. There is no room for him in the navy.

This would provide for Lieutenant Hood his "highest class of engineers," "one for gunboats and smaller cruisers, two for cruisers second class, and three for cruisers of the first class and battleships." I quite agree with him that "any greater number of engineers of the highest class aboard ship is superfluous, and therefore useless. For engineering work under them, the present system of warrant machinists, and machinists of the various classes, supplies just the order of material needed for the work to be performed." I claim that under the system I propose the line officer can do all that is required.

I desire to paraphrase the above quoted sections of the essay as follows:

"But the need of the very highest class of ordnance experts on board ship in the numbers corresponding to the duties to be performed is more crying now than at any time in the previous history of the navy; and that need will become more and more urgent as the navy expands, and ordnance and ordnance devices increase and multiply. And while it will be absurd to use highly trained and educated designing and constructing ordnance experts for training and elevating levermen, ammunition hoist operators, torpedo manipulators, etc., one or more, according to the size and arrangement of the armament, should be on all ships of the navy as officers in charge of the different sections of the armament and superintendents of its machinery, and should be held responsible for the proper working and efficiency of all the mechanical features of the armament.

"For this purpose one would be needed for each different section of the armament, whatever the kind of ship. Any greater number of ordnance experts of the highest class aboard ship is superfluous and therefore useless. For the ordnance work under them, the present system

of gunners, gunners' mates of the various classes, and gun captains, supplies just the order of material needed for the work to be performed."

A similar reading may be given relative to the electrical force, and can anyone deny that the argument rolls out just as smoothly for ordnance and electricity as it does for engineering? I can see no just ground for any such denial.

Such being the case, the conclusion to be reached is obvious. If Lieutenant Hood's argument is sound for engineers it is sound for the other specialists, and we must have an electrical corps of commissioned officers and an ordnance corps of commissioned officers. Why does he neglect to provide these special commissioned corps of Naval Academy graduates for ordnance and electricity when he does so for steam engineering and even for the keeping of pay accounts?

I believe in a line of the navy each member of which shall be able to perform efficiently the daily duties of the ship of all branches, on deck and in the engine-room, and the care and handling of turrets, guns, machinery and torpedoes, the caring for and running of dynamos and motors, and even, iconoclastic as it may seem, the handling of the accounts of the pay as well as of all other departments. Then let each man seek his bent in designing engineering, one or more branches, and with the system of warrant and petty officers now in existence I believe we would have the finest organization in the world.

We now lack officers and we lack all classes of petty officers, and our present troubles spring far more from this than from the system. Get them, and I believe the system I have herein sketched out would give us everything that could be desired.

Leaving personnel and coming to material, I assume that Lieutenant Hood only takes his one hundred and fifty vessel standard fleet for purposes of argument, as otherwise I do not agree with his proportions. For instance, forty gunboats and twenty small cruisers will never be sufficient to perform the police work of a great world-power as we must become. That fleet and more would be kept busy in the Philippines alone all the time, were the heavy ships retired from that kind of work there, as they would be if it could possibly be done. I also trust our battleship development will not stop at twenty.

Also forty torpedo vessels are altogether too few, if they are to be used consistently for coast defense, as I believe they should be. From one hundred and fifty to two hundred would give a very good coast-defense flotilla, and it may be noted that England and France, each with far less coast-line than we have, have well up to those numbers of these vessels.

I also believe Lieutenant Hood's estimate of the number of officers that are needed aboard ship is altogether too low, and in regard to this I cannot do better than incorporate in my remarks a statement which I drafted, in conjunction with Lieutenant-Commander Vreeland, for the use of the line committee. This paper was afterwards submitted to the Senate by Senator Hale, and was printed (Senate Document No. 145, 56th Congress, 2d session), and referred to the Senate Naval Committee

for its use. It covers the present need for line officers more fully, including a statement of the number of officers necessary for manning a battleship. It will be noted that Lieutenant Hood's estimate in regard to the proper commissioned personnel for a battleship is lower than that of the chief of the Bureau of Navigation, which is in turn below that of the pamphlet. I believe that the pamphlet estimate is a minimum for the efficient service of a battleship, and that Lieutenant Hood's estimates for other classes of ships are low in proportion.

The pamphlet referred to is as follows:

"A STATEMENT OF THE PRESENT NEED OF THE NAVY FOR ADDITIONAL LINE OFFICERS BELOW THE GRADE OF LIEUTENANT-COMMANDER, WITH A PROPOSED REMEDY THEREFOR AND AN ARGUMENT IN ITS FAVOR.

"Compiled from letters to Congress from the Secretary of the Navy and the Chief of the Bureau of Navigation, and from other sources.

"*January* 23, 1901.

"1. Owing to an omission, and not through any error, the Navy Personnel Act of March 3, 1899, has failed in one important respect to accomplish what was intended, for while it authorized an increase in the number of commissioned officers of the line (total of old line and engineer corps) it failed to carry with it any measure providing for the supply of graduates from the Naval Academy to fill vacancies then existing and to come.

"2. As a partial remedy this Congress, in the spring of 1900, somewhat increased the number of cadets at the Naval Academy, giving to each Congressman the right to maintain one cadet *at the Academy*, instead of holding up a Congressman's appointment until his cadet had finished his six-year cruise, as had been the rule prior to that time.

"3. On January 1, 1901, there were 138 vacancies at the foot of the list of Ensigns. Adding to this the vacancies for the present fiscal year as laid down in the Personnel Act, and we have that—

"4. The number of vacancies at the foot of the Ensigns' list on June 30, 1901, is 178, the number of vacancies at the foot of the list in each year being at least 40.

"5. The following table will show the effect of the operation of the present law towards filling these vacancies:

Fiscal year ending—	Vacancies at end of year.	Graduates to fill them.	Vacancies left unfilled at end of year.
June 30, 1901	178	52	126
June 30, 1902	166	59	107
June 30, 1903	147	67	80
June 30, 1904	120	60 (*a*)	60
June 30, 1905	100	45 (*b*)	55
June 30, 1906	95	68 (*c*)	27

(*a*) Present second class at Academy; strength on January 1, 1901, is 65.
(*b*) Present third class at Academy; strength on January 1, 1901, is 55.
(*c*) Present fourth class at Academy; strength on January 1, 1901, is 93.

"6. This table brings the calculation down to the time when all the cadets now present at the Academy shall have been commissioned, that is, to July 1, 1906.

"7. Under the old law there were about 31 graduates a year available to fill vacancies in the line, which multiplied by $\frac{3}{4}$ to allow for change in law of last year, will give as a future average about 47 graduates a year to fill vacancies in the line, or an excess of 7 appointments as Ensigns over the year vacancies.

"8. Therefore the 27 vacancies existing on June 30, 1906, would not be filled under the present law until four years later, or June 30, 1910.

"9. The above calculation considers only the number of line officers as allowed by present law. Passing from the line as at present constituted, let us take up the actual need of the navy for officers.

"10. Taking the Indiana as a type of battleship, and considering the number of officers needed to fight her battery effectively, we would have as follows:

1 Commanding officer.
1 Executive officer.
1 Chief engineer.
1 Navigating officer.
4 13-inch turret officers.
4 8-inch turret officers.
2 Main-deck battery officers.
2 Secondary battery officers.
4 Powder division officers.
4 Assistants to chief engineer.
1 Torpedo officer.

25 in all.

"11. Considering the grades of the above officers, we should have for this ship:

1 Captain, in command.
2 Lieutenant Commanders, as executive and as chief engineer or navigator.
7 Lieutenants and Lieutenants Junior Grade, as chief engineer or navigator and 6 watch and division officers.
15 Lieutenants Junior Grade, Ensigns or Naval Cadets, as officers of divisions, junior officers of divisions, assistants to chief engineer, etc.

25 in all.

"12. It is impossible to obtain the highest efficiency from the Indiana with fewer officers than the above, and every officer of rank in the navy who has had battleship experience will testify to that fact.

"13. In his letter No. 244,772 of December 10, 1900, to the Chairman of the House Naval Committee, the Chief of the Bureau of Navigation has stated that the Indiana should have 17 officers. This means that by

cutting to the lowest possible limit, to an extent really unsafe in time of war, the ship can be kept going with that number. In other words, the estimates in that letter are the very lowest possible, without any factor of safety or allowance for casualties, and would leave large and important sections of the battery to go into action without the supervision of an officer. Under it there could be no assistant engineers and no torpedo officer, and the other numbers as estimated here would be cut in proportion.

"14. Accepting the figures of the Bureau of Navigation (the above argument merely showing how low those figures are), the following list of vessels now under construction, which are to be completed by July 1, 1902, and which will require to be commissioned by that date, will show the number of officers required:

Vessels.	Officers.
Illinois	17
Wisconsin	17
Ohio	17
Arkansas	7
Nevada	7
Florida	7
Wyoming	7
Denver	12
Des Moines	12
Chattanooga	12
Cleveland	12
Galveston	12
Tacoma	12
16 Torpedo-boat destroyers	48
15 Torpedo-boats	30
7 Submarines	7
Total	236
25 per cent reserve	59
Grand total	295

"15. To the 236 officers required to actually officer the above-named vessels, a reserve of one-quarter has been added as being the number necessary to allow for those sick, otherwise employed, performing travel to and from ships, at navy yards, at the Naval Academy, and elsewhere throughout the navy.

"16. The following list, similar to the preceding, gives the number of officers required to fit out the vessels now repairing and out of commission. These would all be commissioned in case of war, and many of them would now be in service, were officers and men available, to increase the efficiency of the fleet in the Philippines, for duty in the Mediterranean, where there has been no squadron since 1898, and where ships are always needed in Turkish waters, etc., and to bring the North Atlantic and Pacific squadrons up to the strength which our home defensive squadrons should properly have:

Vessels.	Officers.
Indiana	17
New York	15
Texas	15
Columbia	14
Minneapolis	14
Baltimore	12
San Francisco	12
Olympia	12
Cincinnati	10
Raleigh	10
Detroit	10
Montgomery	10
Marblehead	10
Boston	10
Puritan	8
Miantonomoh	8
Katahdin	6
Alliance	6
Alert	6
Mohican	6
10 Torpedo-boats	20
Total	241
25 per cent reserve	60
Grand total	301

"17. In addition to the above and to look further ahead, we find the following list of vessels building or authorized, which will come up for commissioning subsequent to July 1, 1902, with the accompanying need for more officers:

Vessels.	Officers.
Maine	17
Missouri	17
Georgia	17
New Jersey	17
Pennsylvania	17
Virginia	17
Rhode Island	17
California	15
Nebraska	15
West Virginia	15
Maryland	15
Colorado	15
South Dakota	15
St. Louis	12
Milwaukee	12
Charleston	12
Total	245
25 per cent reserve	61
Grand total	306

"18. As a tabular summary of the above, we have officers needed in addition to present number:

For new vessels completing prior to July 1, 1902	295
For old vessels now in reserve	301
For new vessels completing subsequent to July 1, 1902	306
Total	902

"19. In other words, to officer in the lowest possible manner the navy which Congress has ordered built, there must be provided an increase of 902 in the number of officers now authorized, mainly in the grades of Lieutenant, Lieutenant of the junior grade and Ensign.

"20. Attention is invited to the fact that above estimates do not include officers to man auxiliary vessels which would be used in time of war, such as auxiliary cruisers Yale, Harvard, etc., colliers, supply vessels, refrigerating ships, distilling ships, repair ships, hospital ships, auxiliary gunboats, Gloucester, Scorpion, etc., and all the host of other similar important craft.

"21. The Bureau of Navigation recommends that, for the reasons herein set forth, the following provisions be inserted in the Naval Appropriation bill:

"'*Provided*, That, from and after the passage of this Act, there shall be allowed at the Naval Academy two Naval Cadets for every member or delegate of the House of Representatives, two for every United States Senator, one for the District of Columbia, and ten at large annually; *Provided further*, That the number of Lieutenants in the Navy of the United States shall be three hundred and fifty, and the total number of Lieutenants of the Junior Grade and Ensigns shall be six hundred; *Provided further*, That a Naval Cadet, upon successfully completing his four-year course at the Naval Academy, shall be commissioned an Ensign; *Provided further*, That no Cadet shall be prevented from being so commissioned by any law limiting the number of Lieutenants of the Junior Grade and Ensigns; *And provided furthermore*, that all Acts, or portions of Acts inconsistent with the provisions of this section, are hereby repealed.'

"22. In view of the foregoing statement of the need for officers the request for a present increase of 300 is certainly moderate.

"23. The recent liberal appropriations of Congress for rebuilding and expanding the Naval Academy are taking shape in commodious buildings which will ultimately be ample for the increased number of cadets, and in the meantime, by employing old sets of officers' quarters and otherwise, the immediate increase can be cared for.

"24. In this connection, though it has no bearing upon the actual number of officers available for duty, it is again urged that as a matter of right, justice and efficiency, cadets completing the four-year course be immediately commissioned as Ensigns. Such a measure would in no way remove any difficulty connected with the shortage of officers,

for the increased number of commissioned officers would be gained at the expense of so many cadets at sea.

"25. Any general or special provisions for readmittance to the Navy on any terms of persons formerly in the navy or for placing on the active list officers now on the retired list is most earnestly opposed. Most of the former class who are still capable of performing duty and wish to do so have received appointments in the Pay, Marine and Medical Corps. It is not thought, therefore, that line vacancies could be profitably filled from those sources. Such persons reentering the navy from civil life or being transferred from the retired to the active list are in an anomalous and undesirable situation. They cannot, with propriety, take rank among those with whom they formerly ranked, for they have lost all of the experience and service of the time spent in civil life or on the retired list. On the other hand, having advanced in years, they would not be willing to take rank in that part of the navy which has seen service corresponding with their own.

"26. Lest it should be said that the number of officers herein set forth as necessary for the proper handling of the Indiana, the following table is included, showing a comparison between the estimate of the Bureau of Navigation for the Indiana and the number of officers actually placed aboard ships of similar displacement by foreign powers:

Nation and ship.	No. of line officers.	Remarks.
England,		
Barfleur.....	33	Includes Midshipmen.
France,		
Bouvet.....	26	Includes Midshipmen.
Germany,		
Kaiser Frederich III.....	20	In addition to this there are a number of Midshipmen not here given.
United States,		
Indiana.....	17	Includes Naval Cadets.

"27. From this it is seen that even the estimate of 25 officers as given in the first part of this argument is the lowest complement of the four nations compared, for to the German number as given above, from 10 to 20 must be added for the Midshipmen. England, with the most efficient navy in the world, considers it necessary to have more than 30 officers aboard a battleship of the Indiana class. In the above table the number of officers given includes both line officers and engineers, to make the total correspond with our present line, which has both line and engineering duties.

"28. It will be noted that the above makes no provision for filling vacancies in the Marine Corps with Naval Academy graduates. This should be done, and will call for even more cadets than laid down herein.

"29. The following table shows the duty which officers of the line below the grade of Lieutenant-Commander were performing on January 1, 1901.

Grade.	Number in grade.	Number at sea.	Number on shore.	Number sick.	Per cent. at sea.
Lieutenant	300	180	117	3	60
Lieutenant (Jr. G.)	101	62	38	1	61
Ensign	111	106	2	3	96
Naval Cadet	111	108	3	0	98
Total.....	623	456	160	7	73"

In closing these comments, which have run on to a length never intended by me when I started, I desire to express my profound conviction that we have no room on board ship for any line officer who is a specialist in one branch to the *absolute exclusion of all others.* The doctor and the chaplain, I suppose, we cannot incorporate, and a construction corps that never goes to sea I suppose we must make up our minds to, but the line should include only men who can efficiently perform the daily duties of the old line, the old engineer corps, and of the old pay corps, as required, while each individual is competent to go beyond the daily duties of all in one or more special branches. There is no room in the navy of to-day for the officer who cannot do this.

Incidentally, I may say here that I believe that the sooner the marine corps and navy are merged in one, without prejudice to the individual members of either, the better it will be for the general service.

Therefore, I repeat in closing, *look out for the total and the subdivision will become an easy matter! Work, work, work,* to increase the number of cadets at the Naval Academy, not only to give us the total that we need, but to make sure that a constantly increasing number of vacancies in the line may not invite a flood of appointments of non-graduates, who are not only not specialists in anything, but who cannot perform even the daily duties, and who can never learn so to do. That is the duty that devolves upon every officer of the navy to-day, and I most earnestly beseech each and every one to rally to the preservation of the service from a danger that is only too real. Never mind the interior subdivision, but *attend to the total.*

Rear Admiral JOHN LOWE, U. S. N.—Could I be present to deliver in person that which I would like to say, it would be pleasant to prepare such discussion.

Confined, however, to a letter, I will only say this, that I am heartily in favor of the resuscitation of the engineer corps.

I think it was a mistake to abolish it, and its resuscitation will be for the good of our country and the service.

A healthy man needs a considerable time for recreation, and to be healthy he must not be allowed to do two men's work in one lifetime.

I favor also a Corps d'Elite, to wit, a corps of submarine-boat torpedoists, with a special uniform, for the reason that I believe the future of that mode of warfare will take a broad scope and receive much attention.

Civil Engineer A. C. CUNNINGHAM, U. S. N.—"The present Bureau of Yards and Docks, and the system that has heretofore prevailed of laying out and designing our navy yards and stations under many heads, would seem to be illogical, and has certainly led to much unnecessary expense and confusion. The placing of the whole navy yard system under the one head that controls the great bulk of the work done in them, would seem to be reasonable, and would undoubtedly lead to economy, efficiency and to the adoption of a systematic plan in the arrangement of shops and buildings.

"The present corps of civil engineers is an anomaly in a naval establishment filled with engineering skill, and its members should be joined as an adjunct to construction, which latter branch should have charge of the maintenance of yards, docks and stations, and no further appointments to the corps made. In the future the construction corps should contain its engineering experts to do the duties now performed by civil engineers, just as the line contains to-day its ordnance experts, and for very much the same reasons."

Thus the essayist disposes of the senior bureau and the junior corps in the naval establishment in a manner so at variance with the general tenor of the essay, and so illogically, as compared with some of the most important arguments, that some discussion of the matter is necessary.

When the bureaus of the Navy Department were established in 1842, yards and docks was made the senior bureau, and had the naval establishment developed on the lines proposed by the essayist, it could have been to-day the Division of Materiel, and on a reorganization might more easily and logically become such a division than any other bureau, from the fact that its interests do not in any manner conflict with others, which cannot be said of any other bureau dealing with *materiel*.

The mistakes that have been made in locating and laying out our yards and stations can not be charged to the Bureau of Yards and Docks as such. To some extent its various heads may have been responsible, but it will be more often found that yards and stations have been laid out, and buildings and works located by boards of officers containing few, and sometimes no engineering members. At the present time the Bureau of Yards and Docks has no personal motive in the laying out of a yard or station or in the location of the various works contained therein, but can disinterestedly and impartially serve and guard the interest of all other bureaus. If this bureau were merged in the proposed bureau of construction, the impartiality and disinterestedness in yard design and arrangement would at once disappear, and the proposed leading Bureau of Construction would be arrayed against the proposed Bureaus of Engineering, Ordnance and Equipment, in securing and guarding its own interests.

Whatever reorganization might be attempted with the naval establishment, it would seem that the Bureau of Yards and Docks should naturally and logically be retained.

The essayist in the strongest possible manner deprecates the abolish-

ment of the corps of mechanical engineers, and then proposes to abolish another corps that represents an equally technical profession which existed before that of the mechanical engineer or the naval architect.

Laomi Baldwin, one of the leading civil engineers of his day, was employed by the Navy Department in the late twenties to design and build its first dry-dock, and from that day to this the naval establishment has found constantly increasing uses for civil engineers.

It is but a few years, comparatively, that the civil engineers have been formed into a corps of commissioned officers, and this step in development can but be followed by good results, as has been the case in the successive commissioning of surgeons, paymasters, the late mechanical engineers, and naval constructors. The giving of commissions to civil engineers will be as naturally followed by filling this corps with properly trained graduates of the Naval Academy as has been the case in the corps of constructors, and with equally good results. To abolish this corps and delegate its duties to the constructors, would be following exactly the lines that the essayist so greatly regrets in the abolishment of the mechanical engineer and the delegation of his work to the line officer.

The best reasons for the natural and logical existence of the corps of civil engineers will be found in the following quotations from the essay itself, for whatever can be said of mechanical engineering, or of naval architecture, as professions, can be as logically said of civil engineering:

"The duties of the navy are so varied that there is room for talent of all kinds.

". . . Its chief and assistants should be mechanical engineers of the highest order, and to be such can be nothing else.

"At a time when science in all its branches is advancing with such rapid strides, and when perfection and thoroughness in any profession require the full and entire effort of even a superior mind, and when specialism is the watchword to eminence and success in all professions, to practically abolish one of the most absolutely necessary and most highly specialistic branches of a modern naval service would seem to be contrary to all reason, and the teachings of experience.

"Neither the passing of a law, nor the giving of a title makes the line officer, the engineer or the constructor.

"It will already have been observed that the writer is no great believer in the universal genius of man, and is firmly convinced that the best work is generally accomplished by men who devote their whole time and intellect to one profession."

It will be noted in the quotation at the beginning of this discussion in which the essayist characterizes the civil engineer in the navy as an anomaly, that he also recognizes the necessity of his work and its performance by experts.

Motto:—"Jack of all trades is master of none."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WARSHIP DESIGN FROM A TACTICAL STANDPOINT.

By Lieutenant John M. Ellicott, U. S. N.

Four principal elements enter into warship design, viz., battery, protection, radius of action, and speed. When it is attempted to combine these on a given displacement each crowds the other for space to such an extent that the limitation in displacement has steadily given way, until many students of the subject have concluded that this tendency must be stopped, even at a sacrifice. It is possible, however, that those so concluding are becoming disheartened when almost in sight of the goal, and that only by persistently designing warships which combine the highest tactical elements of their class, on whatever displacement these demand, can we hope to excel.

The order of importance of the elements in the design differs according to the class of vessel. Thus, for battleships, we should consider—

1st. *What combination of guns will produce the most efficient fighting battery?*

This is not a question to be settled by the ordnance expert alone, but by the tactician as well, for the battery carried must be considered, in its distribution, weight of metal delivered and arc of fire, as one of the aggregation of batteries which by tactical movements must be concentrated upon the enemy. To arrive at a solution of this question the consideration of the weight, range, energy and rapidity of fire of modern guns should be combined with a careful study of the best arrangement of guns on shipboard for concentration of fire in fleet actions.

The correct tactical arrangement of guns in a ship's battery is that which will deliver the greatest concentrated energy of fire

upon a vessel of the enemy, but where guns are mounted on shipboard, the necessarily elongated form of the ship makes such concentration possible only in a direction divergent from that of her length. The ship being mobile and dirigible, however, this concentration can be brought to bear toward any point of the compass with the aid of helm and screw. Hence, the strongest tactical arrangement of guns for a single ship's battery is that which gives the greatest possible energy of broadside fire.

A battleship is a unit of a squadron. She is, or should be, designed to fight in tactical combinations with other battleships; to add her greatest concentrated energy of fire to that of other battleships while executing with them similar movements. Being in squadron, she is no longer free to do this by means of helm and screw, for she is constrained to make only such turnings as will harmonize with those of other vessels engaged in the same tactical evolutions. Her battery itself must, then, be capable of the utmost arc of train in order to concentrate upon the same object as the batteries of other vessels. Thus the ideal tactical disposition would be one giving an all-round fire to every gun in a ship's battery and making it possible for every gun to bear in the same direction at once. There is but one way in which this is mechanically possible—to mount all the guns in turrets superposed one above the other in a single vertical column. This, of course, is practically impossible, but it shows that *as far as we can* superpose turrets we are following the dictates of tactics.

An evolution which brings to bear one ship's greatest energy of fire should not waste part of the energy of some other ship. In battleship design, the first effort should be to attain that assignment and arrangement of battery which will permit the greatest possible concentration of energy of fire in any one direction, *then to give similar batteries to every ship of the same class built.*

By superimposing 8-inch upon 13-inch turrets in our battleships Kearsarge and Kentucky, we have obtained a concentrated energy of broadside fire superior to that of any ship of their class in the world, and at the same time we have insured a better end-on-fire than seems possible with guns otherwise disposed in any battleships we have yet built. It is such a vast gain in tactical arrangement of battery that we should not recede from it because it is novel and has not had the test of battle; but should rather

strive to improve upon, or add to it. The structural and mechanical difficulties in installing the superimposed turrets seem to have been successfully overcome, but there is still one defect in them, more apparent than real. That is the rigid connection between the 8-inch and 13-inch turret. It is this seeming defect which opponents of the system strive to bring out by supposing the Kearsarge attacked by a vessel on each quarter, one of these assailants needing the attention of her 8-inch guns. These guns would, it is claimed, take the 13-inch guns with them and leave the Kearsarge's other side to sustain an unequal combat. Such a divided attack, however, even upon the Kearsarge, would be a cardinal tactical error, permitting her to use *all her guns;* whereas a combined attack of her two assailants from one general direction would permit the heaviest concentration of both their batteries upon a portion only of the total battery of the Kearsarge. For illustration, let us suppose this ship attacked by a Kentucky and an armored cruiser. The two battleships would be matching gun for gun, and the cruiser, if concentrating on the same side as the Kentucky, would be delivering her whole broadside unopposed, whereas on the other side she would be receiving the fire of seven additional 5-inch guns. Now replace the Kentucky with another armored cruiser and we have the Kearsarge attacked by two armored cruisers of, say, fifty per cent of her battery power each. If they concentrate on one side of her they will fight her on about equal terms. If they attack on different sides the Kearsarge will be able to concentrate her whole energy of fire upon one of them while using against the other seven 5-inch guns, otherwise idle. It seems hardly necessary to carry the illustrations farther in order to prove that the divided attack proposed is tactically unsound, and should be encouraged by the Kearsarge (if caught in such an emergency) rather than avoided. Nevertheless it can always be rejected by a shift of the helm.

I believe it to be mechanically possible to so arrange the superimposed turrets in new models as to make them turn separately, and thus restore independent mobility, if it is really desirable, to the 8-inch guns.

2d. *What protection must be given to the battery to make it as invulnerable as possible?*

This again is a question for the tactician as well as the ordnance expert, and although fights between armored vessels have not

been numerous, they point very decidedly to the value of protection and the necessity for more of it, *especially protection of the personnel.*

A vast weight of armor is now devoted to a water-line belt, yet in all the history of naval warfare since guns have been used, it is the rarest thing to find recorded a ship sunk by gun-fire. In the days of sails, battleships were placed *hors de combat* by the destruction of their motive and directive power, *i. e.*, their sails, masts and rudders; or by the destruction of their personnel. Now, the motive and directive power can be invulnerably disposed below an armored deck. Should we not devote the further disposition of armor chiefly to the protection of the personnel, instead of so largely to insuring flotation, which history shows us has so seldom been destroyed by gun-fire under any circumstances?

3d. *How far must this battery be carried to attack our most distant possible adversary?*

This is a matter of geographic measurement, and coal-consumption per mile at economic speed, adding sufficient fuel capacity to sustain the ship while establishing a base on the hostile coast.

4th. *At what speed must this battery be carried to insure its coping with any of its class afloat?*

This is a question of boiler, engine and structural design with a view always to equal foreign models, and to excel them when it can be done *on the same weight and space,* for while an excess of speed in battle is unquestionably advantageous, it certainly would not be so at the sacrifice of any other offensive element in a battleship. Speed is of more value in strategy than in tactics.

The four considerations enumerated become, when settled, elements of volume and weight, and it remains to determine—

5th. *What structure must be built to carry them?*

The aggregate of these five items gives the size of the tactical unit of battle afloat—the battleship. The number of these units must be determined from the strategic features of our coasts and the naval force of our strongest possible adversary, and legislators must be kept fully informed as to this need.

This method does not suggest indefinite increase in size, for each item has its limit; in fact, seems to have already reached its limit in the directions of volume and weight. In these respects guns reached and passed the limit some years ago and have

dropped back to lighter weights and calibers. Their improvement now is entirely in the direction of greater strength of material, better explosive propelling agents and a more economic use of them.

Armor seems to have reached its limit in thickness, and invention now turns to increasing its hardness and toughness.

The distance to which we must carry the battery has geographic limitations, while improvement in fuels and methods of coaling at sea may reduce fuel weights carried.

Speed, if increased much in large ships, seems likely to be accomplished by new designs in engines and boilers involving economic use and spacing of motive power rather than increase in volume and weight of generating and transmitting parts.

The consensus of building opinion of the present day, as illustrated by the latest battleship designs, indicates that all the best elements can be obtained on a displacement of 15,000 tons, and we may expect, in the future, to see equally good fighting units, and even better, produced on smaller displacements. Let those who shrink from war vessels of great displacement remember that they insure a special tactical advantage over smaller ones in their greater steadiness of gun platform.

Armored Cruisers.

Land campaigns in the latest wars with up-to-date weapons have demonstrated that it is absolutely essential to success to have a large component of the fighting force specially equipped for mobility, swiftness and great radius of action; in other words, to have a mounted infantry. The campaign in the Philippines made no permanent progress until, with such a force, we could outstrip the ever-fleeing foe and bring him to bay. The campaign in South Africa was a deadlock until the British had a sufficient mounted infantry force to turn the enemy's positions by long and unperceived detours, sever his communications and fall upon exposed points.

Warfare afloat has ever been analogous in its principles to warfare on land. If a fleet at sea should persist in avoiding battle by Fabian Tactics, the opposing fleet, if it possessed only equal characteristics, might fail to bring on a decisive engagement until crippled for want of fuel, whereas, if it were made up in

part of a class of vessels having superior speed and radius, yet retaining sufficient protection and armament to endure the shock of combat, this portion might overtake, cut off or hold the elusive enemy until the main body came up. Again, two fleets of battleships having equal tactical characteristics, might fight to a standstill without decisive advantage, and one or the other might withdraw to shelter, whereas, if one fleet possessed a division of vessels superior in speed, mobility and radius, the other fleet could be shut out of its place of refuge and possibly forced to surrender. The survival of the Chinese battleships in the battle of the Yalu after four hours' hammering, indicates that fighting to a standstill is not an improbable outcome in future naval combats where reliance is placed exclusively upon battleships.

Another feature of great importance in naval as well as land warfare is reconnaissance, and reconnaissance is not satisfactory unless pushed home until the main body and strength of the enemy is disclosed. Vessels suited to this purpose must have coal-endurance for a long search, battery enough to beat-in the enemy's outposts, high speed to dash into close touch with the main body and then to get away, and sufficient protection to stand punishment while under heavy fire.

We should, then, have a mounted infantry of the sea as well as a mounted infantry on land, and the type which will fill this requirement seems to be the armored cruiser.

Armored cruisers, therefore, ought to fulfill the following conditions:

They should be able to overtake battleships in chase within the limits of daylight. This would necessitate a superior speed of at least two knots.

They should be able to keep the sea at cruising speed at least half as long again as battleships, and, if possible, a good deal more than half.

They should have the same protection as a battleship, as nearly as other conditions will allow.

Their reduced battery should be homogeneous in calibers and tactical disposition to that of battleships.

Briefly stated, there must be a sacrifice of battery and protection to speed and endurance, and this sacrifice should be chiefly in battery. As a bare statement, this will be challenged, but it can be shown from our own recent battleship designs that on

about 12,000 tons we can, by sacrificing battery alone to speed and endurance, produce an armored cruiser equal to any under construction.

Take, for example, the Kearsarge. She has a displacement of 12,300 tons with her total capacity of 1200 tons of coal. By taking away her 13-inch guns, mounts, turrets and ammunition, and reducing her 13-inch barbettes to suit the 8-inch turrets we would remove about 1400 tons. On this we can get 2000 tons coal-capacity, add 50 per cent of weight for her motive power and have 100 tons left for such increased weight of hull as would be necessary in fining her lines and increasing space for fuel, and thus produce a ship having a radius of 10,000 miles and a speed of 20 knots, which could take her place, when necessary, in the line-of-battle beside the Kearsarge with the same immunity, and with a similar battery up to and including her 8-inch guns. If we compare such a ship, element for element, with the latest armored cruisers built or building abroad, even with those of greater displacement, we will find that, although sometimes slightly inferior to them in speed or radius, she would in every instance outclass them when brought to battle.

Such is an armored cruiser, and by comparison it appears that her limit of displacement could for the present be fixed at 12,000 tons, with the expectation, as in the case of battleships, that equally good ships of the type can in the future be produced on smaller displacements.

Protected Cruisers.

The functions of armored cruisers with the fleet in time of war are too important for them to be sent to fritter away their endurance by threshing about the theater of war for those bits of superficial information and first touches with the enemy's forces, which serve, by aggregation, to shape the attack or defense, yet there must be vessels to do this, and, from the nature of the work, there should be many of them. They must be ships of greater speed and endurance than warships of any other class, and their endurance should be exceedingly great, not alone in fuel, but in seaworthiness, habitability, distilling capacity, provisions, cold-storage and self-repair. They must have battery enough to whip all improvised and auxiliary war

vessels, and to fight, with at least even chances, any vessel of their own class—but it is not their duty to fight vessels of a superior class. They should be protected from such by their greater speed and by an armored deck over their motive and directive power, which would insure their escape from gun-fire before being crippled. Their ammunition hoists should be heavily protected, but gun positions need only protection from rapid-fire projectiles; the limit of thickness of such protection being that above which some sacrifice of special type characteristics of these vessels would enter in.

Such a vessel is a protected cruiser. When with the fleet, or operating for the fleet in time of war, she is a scout.

More war vessels have been built approximating to this type than to any other, yet they have seldom been designed to take their legitimate place in the war fleet. Some are merely economic structures built to "show the flag" in foreign ports in time of peace. These are always deficient in speed and some branch of endurance. Others are designed solely as "commerce-destroyers" and have insufficient battery and protection. Commerce-destroying, however, except with an otherwise impotent naval power, should only be incidental to the operations of naval warfare, and is not worth a special design. Protected cruisers designed for their legitimate war purposes as swift, enduring, well-armed seekers of information, or scouts, will also fulfill the highest requirements of commerce-destroyers, or of cruisers for the peace establishment. They are also of the type needed for commercial blockade and search and for protecting landing parties.

A protected cruiser, therefore, should fulfill the following conditions:

1. She should be the fastest ocean-going war vessel afloat.

2. At economic speed, her fuel endurance should exceed that of all other types of war vessels.

3. She should excel all other types in her provision capacity, distilling and freezing apparatus, and workshop appliances, and she should be sheathed.

4. She should have a complete protective deck, heavy enough to keep out the largest projectiles. Her cellular subdivision of hull should be the most complete now designed. Her bat-

tery should be protected from secondary-battery fire as much as other requirements permit, while her ammunition hoists, conning-tower and helm connections should be heavily armored.

5. By comparing protected cruisers of different countries it will be found that, to equal the best armed ships of the type, the battery should be at least four 8-inch guns, ten 6-inch R.F. guns, and secondary guns in proportion.

After carefully scrutinizing the characteristics of all protected cruisers built and building the world over, there seems to be no better type on which to base modifications than our own cruiser Olympia. With all coal aboard she is a 6000-ton vessel. By increasing her displacement 2000 tons she could be made a 23-knot ship, with 16,000 miles radius of action, carrying a battery superior to that of any vessel of her class, and with protection adequate to the type. This would make the maximum displacement for a protected cruiser 8000 tons.

Gunboats.

Now that we have turbulent insular possessions full of intricate waterways, as well as growing interests in unstable countries accessible chiefly through long and shallow rivers, it is important that we should consider more carefully the characteristics needed in gunboats. A study of our gunboat-work in the Philippines will teach us that there is a special sphere of work for such vessels; in sweeping the shoreline ahead of advancing troops, protecting their shore flank or enfilading that of the enemy; in making reconnaissance of narrow and intricate channels and cutting out small craft, and in ascending rivers to keep open communications and convoy supplies to interior points.

They will thus be constantly exposed to small-arm and machine-gun fire, and a special feature of their construction should be adequate protection against such fire. Above-water plates should be thick enough to keep out small-arm bullets, and bulwarks should be constructed to serve like breastworks. Such protection should extend to the positions of those navigating the vessel, including the lookouts aloft. This could and should be done to gunboats and picket boats already built. If it were, we would escape such mortifying disasters as that to the Urdaneta at Orani.

Gunboats must, as we know, be of light draft, which can be determined by a study of the hydrography of their probable stations. They should carry the best rapid-fire and machine-gun battery commensurate with their size, and have as much coal and provision endurance as possible. Speed is of minor importance, and sheathing would be superfluous, for they can be hauled out almost anywhere at small expense and cleaned.

Coast Defense Vessels.

Coast defense means harbor defense. If batteries are to be mounted for the defense of a harbor, they should be mounted on shore and not afloat, for they can not only be made more invulnerable and carry greater armament, but their ever-steady platforms and the greater possibility of range finding render their fire immeasurably more accurate. There is a tendency in this country to build monitors for harbor defense, and I once thought they had their place in the composition of the fleet; but further tactical reflection, and their recent behavior off the coast of Cuba, have reversed my opinion. They are tactically useless except in smooth water. A monitor is but the first crude material shape of a tactical idea, *i. e.* of an invulnerable revolving battery upon an unsinkable hull. The battleship of to-day, especially with superposed turrets, is the evolution, the perfection of the monitor, retaining the tactical advantages of the latter in the turrets and protective deck, and remedying by a vaster structure the tactical shortcomings of unstable platform, low freeboard, limited speed and endurance and small battery. The real coast defense vessels are battleships on the high seas ready to fall upon the enemy in whatever port he strikes. There may be some harbors whose configuration calls for defenses at points where there is no land, but they are few in number, and can be definitely picked out by local tactical examination. In these, monitors would be useful; perhaps necessary, but I suspect that we already have plenty for that purpose. To my mind the only special type of vessel needed for harbor defense is the torpedo-boat, and torpedo-boats will never figure largely in any war of ours except as harbor defense vessels. For this purpose we should continue building them until we have a flotilla for every important harbor in the country, and should thereafter maintain them in number and efficiency.

Naval Auxiliaries.

If all naval auxiliaries were to be specially designed and built by the government it might, perhaps, be ideal, but their care and maintenance in peace times would be an expense out of all proportion to the tactical advantages to be gained from such designs in time of war. Nevertheless, there are two types of auxiliaries which both tactics and strategy demand shall be ever near or with the fleet in time of war, and which could always add to its mobility and efficiency in time of peace, viz., the collier and repair ship.

Von Moltke, having land campaigns chiefly in mind, said that strategy was three-fourths geography. Had he been an admiral, I think he might have added "and one-fourth coal." Other things being equal, that combatant which best solves the problem of coaling its fleet in time of war, will come out victor. All sea powers realize this, as is evinced by their efforts to seize islands and establish coaling stations here, there and everywhere in the waters of the oceans; yet every student of strategy knows that such coal piles will be used by whichever contestant proves to be the stronger highwayman in their vicinity for the time being. Briefly, the disadvantages of a coaling station are:

Its location is exactly known to the enemy.

If it lies on your line of communication toward him it is equally on his toward you, and will be as accessible to him as to yourself.

It is immobile and must be sought at greater or less distance from the theater of operations.

On the other hand, for colliers, we have the reverse conditions: They are mobile and can be sent to any desired rendezvous, and away from it again, if necessary, after coaling from them, or they may be kept constantly with the fleet.

They need never serve to replenish the enemy's bunkers, for they can be sunk when in danger of capture.

Even with coaling stations, colliers are ultimately necessary for replenishment, and in the long run the possession of coaling stations is but an added risk of serving the enemy.

Of course the great advantage of coaling stations, in fact their only *raison d'être* as a strategic precaution, is that they

afford harbor facilities for coaling, but the problem of coaling from colliers at sea seems fairly solved, and if coal is kept afloat with the fleet in time of war, it will not be difficult to find sufficient shelter to permit its transfer to the bunkers when necessary.

If, however, colliers are to accompany the fleet, they must not be in any sense impediments. They should be specially designed and navy-built, with the following characteristics:

A cruising sea speed at load draught equal to that of battleships.

Devices for trimming with sea water to maintain their immersion as their cargo is diminished, or to keep them sufficiently immersed to maintain their speed.

All the recent appliances for coaling vessels at sea.

Arrangements to quickly sink the vessel when necessary to avoid capture.

Ample equipment for quickly abandoning ship in such an emergency.

A well arranged battery of light rapid-fire guns, with protection to navigating positions and to battery sufficient to keep out projectiles of its own calibers.

A protective deck over boiler and machinery spaces.

The necessity for repair ships of the Vulcan class was demonstrated fully in the Spanish-American war. They should be navy-built and maintained in peace times as well as during war. One at least, should be on every station we maintain, and they should accompany their squadrons in cruises and maneuvers. They would not only add to the tactical efficiency of the fleet at all times, but would, by curtailing expensive sojourns at navy yards, prove an actual monetary saving to the government.

The Number of Ships.

While it is of vital importance to determine by careful study the best types, characteristics and sizes for warships, it is of equal importance to develop a definite, continuous and progressive building program. To this end, we should study the methods of the country or countries most closely comparable to ours in commercial and colonial conditions and in national rank. Take Germany, for instance—a young nation with an

agricultural, manufacturing and commercial population; with a littoral and interior water communication similar to ours; with a growing, world-wide trade, and with newly acquired colonial possessions. She is closest to us to-day in naval power, and we will run a close second to her in naval construction for the next four years. She has, moreover, a carefully matured program already established by far-reaching legislation, which is to bring her navy up to a certain strength in a certain number of years and to maintain it at that strength thereafter.

We cannot, with certainty, maintain our position as a world power unless we adopt some such program. It is a problem which can be solved by answering the following questions and acting upon the answers:

1. How many battleships should we have to-day in order to cope on equal terms with any other first-class naval power?

2. That number provided for by a program covering the briefest practicable length of time, how many additional battleships must we build each year to maintain a total force in undiminished proportion to that of our strongest naval competitor?

3. What should be the retiring age of a battleship, and, that determined, what yearly construction will be necessary to fill vacancies caused by retirement?

The above three questions answered will give us a definite number of battleships to be built each year for a period reaching continuously into the future as far as construction in other countries will give us data for computation. Next, to insure tactical homogeneity in the fleet we should determine that—

For every N battleships there should be X armored cruisers, Y protected cruisers, Z navy-built colliers and Z^1 navy-built repair ships.

We are separated by oceans from all other great naval powers. It seems reasonable to presume that none of them could afford to send more than half their battle fleet away from home waters in a war with us. Great Britain is the greatest naval power and has fifty battleships. We should, then, have twenty-five built or nearing completion. We actually have fifteen and should provide ten more in the shortest time practicable to make up our deficiency. At the same time we must watch the yearly budgets of all other naval powers and build additional battleships in proportion to our closest competitor.

The only country which has, as yet, placed a legislative retiring age upon warships, is Germany. She retires battleships after twenty-five years' service. Without exact data we would do well to adopt that figure in order to maintain a definite building program.

Being thus able to designate exactly the number of battleships which should be laid down each year for as many years ahead as we please, the number of vessels of other classes to be built should be worked out proportionately from tactical considerations. If the correct tactical use of armored cruisers is that which I have suggested in the early part of this paper, *i. e.*, as a mounted infantry of the sea, they should constitute about one-third the line of battle. It may be stated then, that for every *two* battleships there should be *one* armored cruiser.

Scouts cannot be too numerous. It is conservative to say that to every ship-of-the-line should be built one scout. For the three ships above enumerated there would thus be three protected cruisers. Basing them upon the battleships it may be stated that for every *two* battleships there should be *three* protected cruisers.

Gunboats, being designed for special purposes and localities, are not, tactically, a part of the battle fleet, but tactics demands a due proportion of colliers and repair vessels in a theater of operations. The six vessels which would be provided in the preceding apportionment would carry 9000 tons of coal. They would need two 5000-ton colliers ever present with them to refill their bunkers. They should also be accompanied by one repair ship. The algebraic expressions in the tactical rule for new construction can, then, be replaced by figures, thus:

For every 2 battleships there should be 1 armored cruiser, 3 protected cruisers, 2 navy-built colliers and 1 navy-built repair ship.

The building of ships is not alone sufficient to maintain an adequate navy. It is imperative that the personnel shall expand with the material. In 1882, it was decided by the Navy Department that 1500 officers and 7500 men constituted a sufficient permanent personnel for sixty vessels of the kind we then had. Since then, the navy has increased 75 per cent in number of ships, many of them vastly larger and more complex than those of 1882, and the enlisted force has been almost proportionately increased, while the commissioned personnel has re-

mained practically unchanged in aggregate numbers. This attenuated condition of the officers' list is not only alarming, it will soon become irreparable, for it takes longer to make an officer than to build a battleship. On our own officially stated basis of 1882 we should now have at least double the number of officers, in all grades, that we actually have, and it should be a matter of fixed law that the personnel, both officers and enlisted men, should ever hereafter be proportionate, year by year, to the ships fit for service.

The Spanish-American War has given the people of the United States two great object lessons in the usefulness of a navy. The legislative branches of the government, in accord with the newly awakened appreciation of the people, seem ready to respond to the naval needs of the nation. Now, therefore, is the time when we, whom the nation has trained to fight its battles on the sea, should tell Congress in no uncertain way the equipment we need to do that fighting. Only the artisan knows what tools he needs in his art.

The hand-to-mouth policy will no longer do. We have become a world power, "whether we would or no," and we have got to arm for international strife, or we will be despoiled, maltreated and thrust into oblivion by our neighbors. If we can formulate a plan for naval armament which is adequate, progressive and definite, Congress will, I believe, legislate upon it from year to year with much less debate and curtailment than that which now follows our desultory demands.

That nation which is best prepared to maintain its position in the great community of world powers *vi et armis* is most likely to have peace.

Appendix.

Weights removed from Kearsarge by taking out her 13-inch battery, as shown by "Report of the Secretary of the Navy, 1896," pp. 280 and 281:

Approximate weight of 13-inch :	TONS.
Barbettes, bolts, nuts, and wood backing	610
Turrets and attachments, and wood backing	530
Guns and mounts	375
Ammunition	160
Turret-turning machinery	100
Total	1,775

Replaced by :		
Structural parts common to 8-inch and 13-inch turrets	160	
Barbettes for 8-inch turrets	200	
Turning machinery for same	15	375
Net reduction in weight		1,400
Replaced by :		
Additional coal	800	
Increased motive power	500	
Changes in hull	100	1,400
		0,000

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A METHOD FOR DETERMINING THE TACTICAL DIAMETERS AND OTHER MANEUVERING POWERS OF SHIPS.

Description arranged by Lieutenant L. H. CHANDLER, U. S. N.

The writer lays no claim to having originated this method, it having been suggested in the summer of 1900 by Lieutenant-Commander W. I. Chambers, U. S. N., and used at that time aboard both the Texas and Massachusetts. Whether or not it is original with that officer is not known, but the writer has never been able to discover it in print and deems it worthy of being put into such shape as to be readily accessible to the service at large. Hence the preparation of this article.

In the description that follows, the case of the U. S. S. Massachusetts has been taken, the observations being made some miles to the eastward of Boone Island Light, off the coast of Maine.

In this method three observers are necessary as follows:

A. One at the bridge compass, who has pasted on the glass of the compass a dumb card showing only every second point as North, NNE., NE., etc. This dumb card should be so placed that its north point is at the forward lubber's point, and, as a result, observations taken from it will merely show the angle of the object from the bow, and will have no magnetic value. The compass is thus practically converted into a pelorus with its zero set to head and graduated only to every 22½°. (This might be advantageously modified perhaps, by making this dumb compass show every twenty degrees, which would knock out fractions and simplify plotting.)

B. One at the pelorus, which is set with its zero to head and kept that way throughout the observations. Angles observed

with it have therefore no magnetic values, but are merely angular distances from head to object.

C. One in a boat, who measures the distance of his boat from the ship by stadimeter at every blast of the ship's whistle.

There are three objects necessary upon which to take observations, and, lettering them to correspond with the letters above given to the observers who take them, they are:

A. A distant, stationary object, at such a distance that its bearing from the ship will practically remain the same as its bearing from the boat throughout the maneuvers. It will be noted later that this point of distance of object is very important, as the accuracy of the results depends upon it.

B. A boat, which shall be so fitted with a drag as to have the same drift as the ship. It is suggested that a heavy weight at the bow and another at the stern of the boat, lowered to a depth equal to the draft of the ship, with a sheet of canvas stretched between the two supporting lines will make an excellent form of drag for this purpose. Assuming that the boat, which of course must not be anchored, has thus been given the same drift as the ship, it is evident that the said drift may be neglected, and the question will therefore be considered as if no drift were present. In order that the drift of boat and ship shall be approximately the same, it is important that there shall be little wind or sea, or otherwise the drag will not have the desired effect, and the boat will go to leeward faster than the ship.

C. The ship herself.

Having everything ready as indicated above, the boat is lowered and left behind. It will be found convenient to steam some distance away from both boat and distant object, and then turn and head for them both on range or nearly so. This is not absolutely necessary, however. Then the swing should be begun as near the boat as practicable in order not to get any further away from her than necessary. Of course the possibility of taking observations accurately between boat and ship will limit the ship's approach to the boat, but having due regard to this, the nearer the two are together throughout the swing and the farther the distant object is from the two, the less will be the error introduced by the assumption that the bearing of the distant object from the ship remains the same as that from the boat throughout.

When in the proper position relative to the boat, with both boat and object bearing North by dumb compass and pelorus, blow the whistle and put the helm over, say to starboard, recording bearings and stadimeter distance of ship from boat.

Observer *A* then promptly sets his azimuth circle on NNE. by dumb compass, and when the distant object crosses the line of the vanes he gives the word "mark" and blows the whistle. At "mark" observer *B* notes the bearing of the boat by pelorus in degrees, and observer *C* records the distance of the ship from his boat in yards by stadimeter.

This process is repeated every time the bearing of the distant object changes two points by dumb compass.

In swinging it must be borne in mind that the least distance to which the service stadimeter is marked is 200 yards. Also that, as long as the distance does not get below that limit, the less the distance is between the boat and the ship the less the error in the stadimeter reading is likely to be.

The speed may be in a measure followed throughout the swing by having the engine-room counters read at every whistle blow.

The results should be finally tabulated as shown in Plate I.

Having obtained the data tabulated in Plate I, take an old chart, having on it a compass rose marked in degrees, and assume the boat to be at the center of the rose. Another useful device that can be used for this purpose is compass Form II, the dygogram sheet, which has been used for plotting on Plate II, the center of the graduated circle being taken as the position of the boat.

Lay off from this center the angles shown in the eighth column of Plate I, measuring on each line thus drawn the corresponding stadimeter distance, and the curve is easily plotted. The assumption is that the line from the boat to the distant object is parallel to that from the standard compass to the same object, and therefore that the angle between the distant object and the boat as seen from the compass will be equal to one hundred and eighty degrees minus the angle between the compass and the distant object as seen from the boat.

It will be noted that observers *A* and *B* will naturally be so near together that one recorder can care for them both.

Also, if the assumption be made that these observers are directly over the turning point of the ship, which will generally

be nearly correct for observations taken from the bridge, the observations taken by *B* will enable the keel line of the ship to be plotted for each position.

(On Plate II it will be noted that certain inaccuracies exist as regards drift angle. For instance at Position 12, the keel line of the ship should be at right angles to the line through the lighthouse and the boat, but it is not so on the plate. The keel lines shown on this plate were plotted as described in this paragraph, and there is no apparent reason for this inaccuracy. The results being those obtained from the Massachusetts, there may have been some error in observing or recording which has given this discrepancy. Its existence does not affect the general description herein set forth, so no effort has been made to reconcile it.)

The great advantage of this method is that all magnetic bearings are eliminated, and hence errors due to drag of compass, etc., do not enter. Also, the effect of current is fairly well eliminated.

The disadvantage of the method is that the distant object observed must be at a very considerable distance. It is thought that in general this condition can be obtained, however. If this distance be too short, the resultant error can be reduced by so conducting the swing that the line passing through the distant object and the boat shall also pass through the center of the circle instead of being tangent to it. It will be found that if the line of bearing of boat and object be tangent to the turning circle, a maximum error of one degree will result when the object is 32.5 miles away, with a ship whose tactical diameter is 1000 yards, and when the object is 16.3 miles away with a ship whose tactical diameter is 500 yards. Of course if the line of bearing of boat and object be made to pass through the center of the circle, or approximately so, tactical diameters of twice the above length may be determined from objects at the stated distances without exceeding the maximum error of one degree.

Other tactical qualities of the ship, such as the S turn can be determined in a similar manner.

PLATE I.—TACTICAL DIAMETER.

Ship—U. S. S. Massachusetts.
Date—September 16, 1900.
Place—Off Boone Island, Maine.
Speed at beginning of swing { .. Knots.

Wind—{ Direction, N.W.
Force, 1-2.

Sea—{ Character, Smooth.
Direction, ...

Distant Object Observed—Boone Island Light.
Distance of Object—15 miles.
Helm—Starboard, 35°.
Engines—{ Starboard, Ahead.
Port, Ahead.

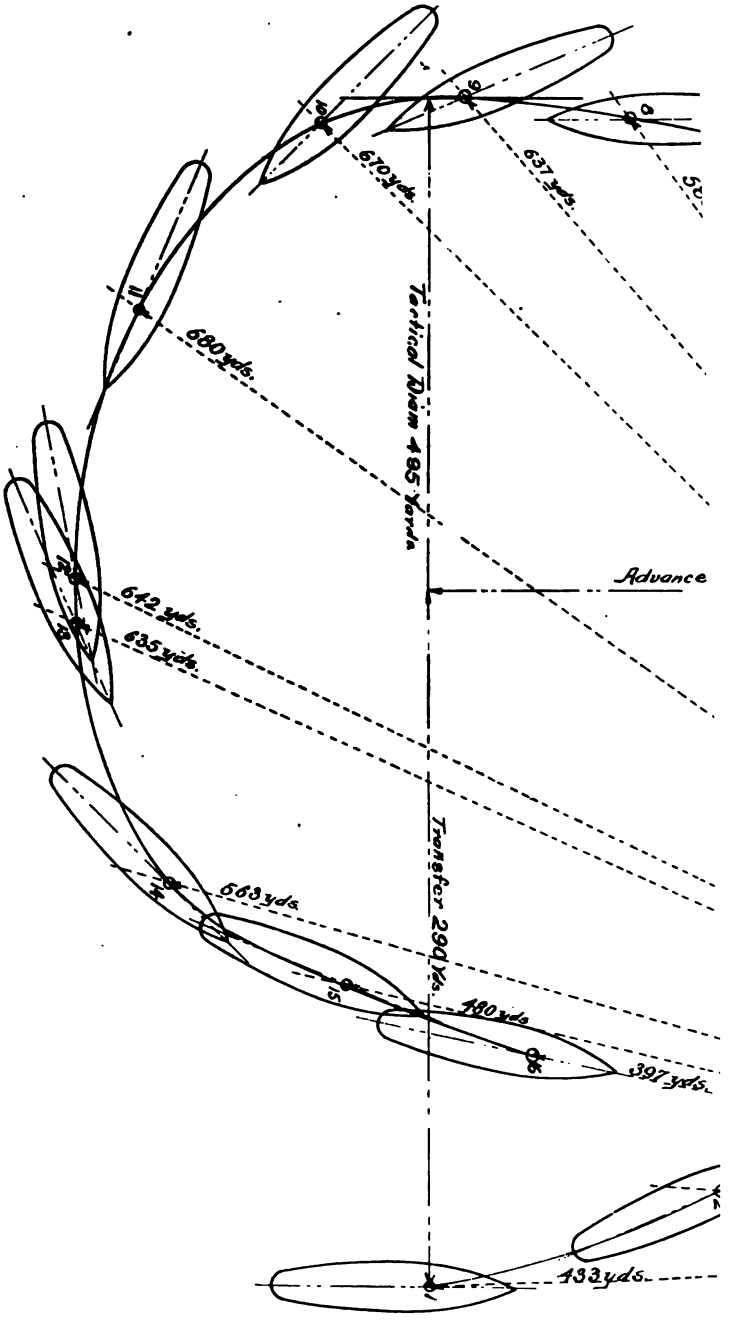
	Record of Ship.			Record of Boat, Observer "C."				
	Time.	Observer "A." Bearing of Lighthouse.	Observer "B." Bearing of Boat.	Recorded Time.	Corrected Time.	Distance, Yards.	Difference of Bearing of Boat and Lighthouse, Degrees.	Remarks.
1	[illegible]	N	N [illegible] W	4 05 30	3 55 30	430	2 W.	
2	[illegible]	N N E	N [illegible] E	4 06 12	3 56 12	312	4½ E.	
3	[illegible]	N E	N 64 E	4 06 32	3 56 32	230	19 E.	
4	[illegible]	E N E	[illegible] 50 E.	4 06 52	3 56 52	225	42½ E.	
5	[illegible]	E	[illegible] 61 E	4 07 08	3 57 08	250	59 E.	
6	[illegible]	E [illegible]		4 07 [illegible]	3 57 [illegible]	305	....	View from Polarus obstructed.
7	[illegible]	E	[illegible] 71 W	4 07 46	3 57 46	427	60 E.	
8	[illegible]		[illegible] 51 W	4 08 30	3 58 30	585	51 E.	
9	[illegible]	S W	[illegible] 41 W	4 08 57	3 58 57	627	49½ E.	
10	[illegible]	W	W	4 09 18	3 59 18	650	45 E.	
11	[illegible]	W S W	N [illegible] W	4 09 40	3 59 40	690	35½ E.	
12	[illegible]	W	N 64 W	4 10 08	4 00 08	642	26 E.	
13	[illegible]	W N W	N [illegible] W	4 10 37	4 00 37	625	24½ E.	
14	[illegible]	N W	N [illegible] W	4 10 56	4 00 56	583	16 E.	
15	[illegible]	N N W	N [illegible] W	4 11 24	4 01 24	480	13½ E.	
16	[illegible]	N	N [illegible] E	4 11 45	4 01 45	307	12 E.	

Standard time is that of Ship Observer
Error of time of Observer "C," 10 min. fast

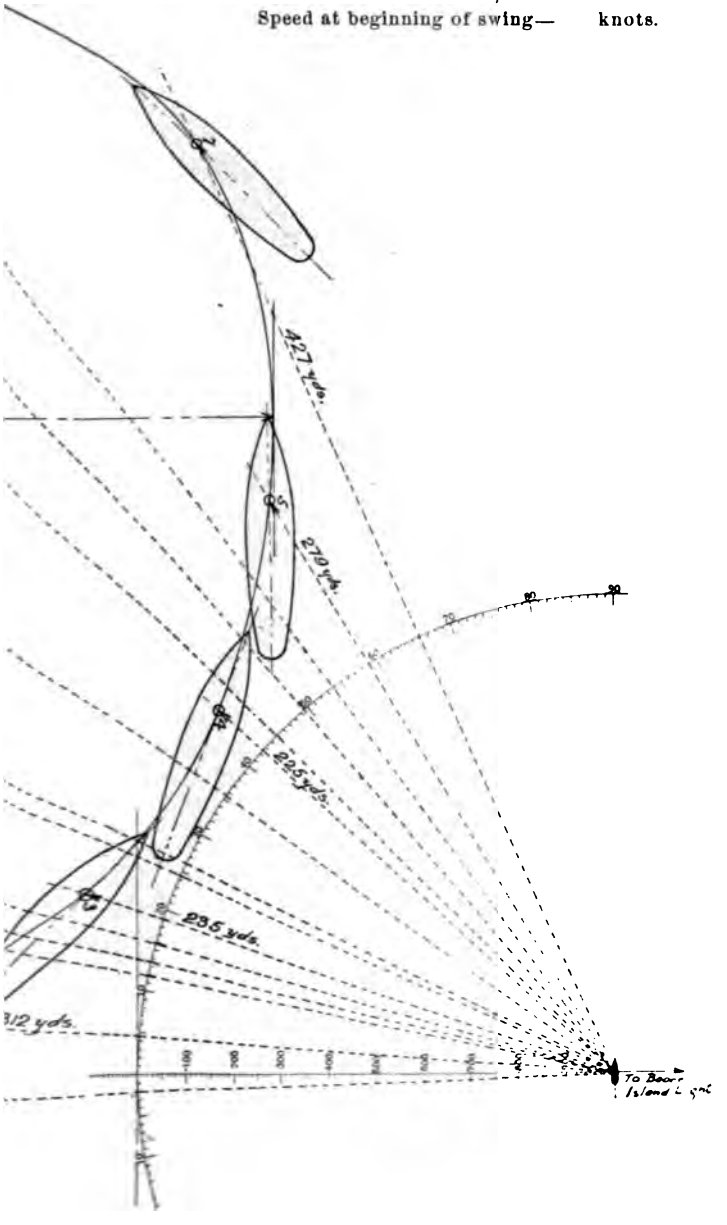
Result { Tactical Diameter, 2½ yards
Advance, 798 yards
Transfer, 380 yards
Time, Tenth Turn, 2 sec.

NOTE.—View was obstructed for bearing of object S.S.E. No observation on that bearing.

PLATE 1


670 yds.
637 yds.
680 yds.
Tactical Room 495 Yards
Advance
642 yds.
635 yds.
663 yds.
Transfer 290 Yds.
480 yds.
397 yds.
433 yds.

Ship—U. S. S. Massachusetts.
Date—Sept. 10, 1900.
Place—Off Boone Island, Maine.
Speed at beginning of swing— knots.



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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON FIRING INTERVAL, WITH EXAMPLES.*

By LIEUTENANT CHARLES B. McVAY, U. S. Navy.

(1) Were a gun mounted on shore and fired at a stationary target, a telescope sight being used, then:

If the gun returned to battery in its original position (which assumes that there is no movement of the mount), the gun-pointer would see the target in its original position in the telescope field. If he watched the splash of the shot in the field and placed the target at that point for the succeeding shot, he would score a hit.

Suppose the target to have been placed at the junction of the right vertical and horizontal wires and the splash noted at x (Sketch 1). This would show that the shot was high and to the right. If he now put the target at x, it would be necessary to lower the muzzle of the gun and train it to the left, correcting his errors.

This is impracticable for a gun-pointer on shore, as the gun will not return to its original position; and is absolutely impossible at sea because the ship moves a considerable distance (1.7 feet for each second of flight at speed of 1 knot) between the times of firing and shot striking, as well as the fact that the ship rolls or yaws through a considerable angle, as will be shown later.

It might be possible, however, for an observer, with a telescope similar to the one mounted on the gun, to stand behind the gun and, keeping the target in the proper position, to note the splash. For instance, if both telescopes were notched for every 5 knots

* For part of data I am indebted to Professor Philip A. Alger, U. S. Navy and Lieutenant L. C. Bertolette, U. S. Navy.

speed on horizontal wires, and had similarly spaced notches on vertical wires as in Sketch 2,* and the gun was FIRED when the target was on the right and horizontal wires, then, if the observer noted the splash at *x*, he could say "3 right, 2 up." The gun-pointer would keep his sight at the original elevation and could, by placing the target at *x* in his field, make a hit without knowing the range.

(2) Paragraph 1 would hold good only when the gun was FIRED when the target was as stated. If the gun-pointer pulled the lanyard or pushed the button at that time, he must know his *firing interval*, which is assumed to be the time elapsed between thinking of pushing the button and shot leaving the gun.

Time after time it has been seen that a gun-pointer, in sub-caliber practice, will hit, miss, hit, miss—the misses being due entirely to the fact that his "firing interval" had been neglected. Perhaps the turret was being trained or was swinging to the right and he made a hit by pushing the button when the target was on the right vertical and horizontal cross-wires. He saw the target moving along the horizontal wire and pushed the button when the target was on the right vertical wire. If the turret be now trained or swung to the left he cannot push the button when the target is on the same vertical wire, because, in the first shot, the gun may have been FIRED, not when the target was on the right vertical wire, but when it was at *a* (Sketch 3), so that he has corrected for but 4 yards at 1000, though thinking that his correction was for 8 yards. If the turret is now trained to the left and the button is pushed when the target is on the right wire, the target will have reached "*b*" when the gun *fires* and he misses by 12 yards. (Errors double at 2000, treble at 3000, etc.) Therefore, to make a hit by using the same correction as for shot No. 1, the button should be pushed when the target is at the center of the horizontal wire.

While the firing interval is greater when using a lanyard, it is considerable when electric attachments are used and should never be neglected.

(3) Frequently men ask what effect the speed of training has on the shot. As far as the lineal movement given the projectile is concerned, it has practically no effect, and the resulting lateral error is small.

* Corrections for abeam.

The slowest possible train of the Amphitrite's turrets gives a velocity of gun-muzzle of ½ foot per second, and a lower speed of training causes a jerky movement. It is probable that the average speed of gun-muzzle is twice this or about 1 foot per second with a good man at the training-wheel.

Assume a speed of gun-muzzle of 1 foot per second and a range of 2100 yards. The time of flight (10-inch B. L. R., 30-cal., 1700 f. s.) is 4 seconds. This would result in an error of only 4 feet and may be disregarded.

The error resulting from a fast train is caused by the angular velocity of the target across the telescope field and not by the linear velocity given the projectile laterally.

Suppose the turret to be trained at a speed of 1 foot per second (speed of gun-muzzle). Knowing the distance of the muzzle of the Amphitrite's guns to be 25 feet from the center, the angle through which the turret trains in 1 second must be one whose tangent is 1/25 and the angle is 2° 18′ = 138′.

At 1000 yards the telescope cross-wires only subtend an angle of 56′—(Sine 1/2 = 8/1000), so that if the turret moves through an angle of 138′ in 1 second, the target moves across the telescope field 138/56 times the distance subtended by the vertical wires, approximately 2½ times.

Since, from experiment, we know that the vertical wires subtend 16 yards at 1000 yards, this means that the target would move across the telescope field with an angular velocity such as to give a lateral error of 40 yards if the firing interval was one second.

Analyzing the firing of the gun so that the firing interval may be understood, we have:

Variable—

1. The gun-pointer sees the target on the wire and thinks "I will fire."
2. He pushes the button.

Constant for similar guns—

3. The primer fires, charge is ignited and the projectile starts from its seat.
4. The projectile travels along the bore and leaves the gun.

Up to the instant the projectile leaves the muzzle of the gun, the angular movement of turret affects the aiming point.

In the absence of any data regarding the firing interval, it has been found to be approximately 1/5 second, as follows:

At 700 yards' range, the average allowance for firing interval made by the members of the gunnery classes when using a taut lanyard was 5.6 yards; that is, when the target was seen on a vertical wire they thought "I will push the button."

Assuming the speed of gun-muzzle to be 1 foot per second, the tangent of the angle trained through in 1 second would be $1/25 = 2°\ 18'$, and this would result in an error of 29 yards at 700 yards ($x = 700 \times \text{Sine } 2°\ 18'$).

The average allowance was but 5.6 yards however, so that the average firing interval would be $5.6/29 = 1/5$ second.

Taking this firing interval and the angular velocity due to a speed of 1 foot per second, we find that the target would move across the field so as to cause a linear change in aiming point of $40/5 = 8$ yards at 1000 yards. To allow for this error (8 yards at 1000 yards), the button must be pushed when the target is at "*a*" for right train and "*b*" for left train (Sketch 4).

The smallest error has been considered and this does not account for wild firing in a seaway.

In a seaway there is a much greater angular velocity in the horizontal plane due to yawing and a similar velocity in the vertical plane due to rolling. Considering these in connection with the firing interval the true cause of error is found—neglect of firing interval.

Considering the question of rolling, we find that the effect is similar to that caused by rapid training or yawing. As far as the linear speed is concerned, the error may be neglected.

If we take the distance of the muzzle of a gun from the center line of water plane, we get the radius of the arc through which the muzzle of the gun moves.

For the Amphitrite's 10-inch turret guns this radius is 27′. For this class of vessel, whose period is very short, there is an extreme roll of 8° in 6 seconds. The muzzle moves 3′.77 above and below the horizontal as the ship rolls away from or toward the target. This distance is passed over in 3 seconds, so that the average speed of muzzle is 1.25 f. s. Assuming the maximum speed to be twice the average speed, or 2.5 feet per second, and knowing the time of flight for different ranges, this error may be calculated. Range 2100 yards T 2100 = 4 sec. The vertical error (due to speed of rolling) would be $4 \times 2.5 = 10$ feet.

As stated above, this error does not account for bad firing in a seaway, so that we must again refer to the firing interval. With the Amphitrite's extreme roll of 8°, period 6 seconds, the average angular velocity is 1⅓ degrees per second. If we assume the maximum angular velocity (when the ship is upright) to be twice this, we get 2⅔ degrees per second.

If the average firing interval be taken, the error in elevation due to roll would be $2\frac{2}{3} \div 5 = 32'$. If the button were pushed when the target was on the horizontal wire and rolling away from the target, then at 2100 yards, the elevation would become 2° 47′ instead of 2° 15′, and the shot would strike 450 yards beyond the target (since 2° 47′ is elevation for 2550 yards), giving a vertical error of 57 feet (Sketch 5). If the vessel was rolling toward the target the elevation would be reduced by 32′, or from 2° 15′ to 1° 43′, and the shot would strike 557 yards short (since 1° 43′ is the angle of elevation for 1543 yards).

Fortunately, there is a short period at each end of a roll when the ship is at rest. If the gun is fired at either of these times the vertical error due to the firing interval is diminished and may become zero.

Consequently, for large-caliber guns, "fire when on the target at the end of a roll."

RAPID-FIRE GUNS WITH SHOULDER PIECES.

(5) These guns are fitted with bar-sights carrying a sliding leaf to correct for speed and wind.

By experiment, it has been found (for Amphitrite's guns) that a movement of one division corrects for 3 yards at 1000 yards, 6 yards at 2000 yards, etc.

With these guns, it is comparatively easy to keep the line of sight on the target.

While the firing interval must be considered, it plays a less important part than in the case of large-caliber guns. The general rule for firing rapid-fire guns is: "Fire when on the target."

SIGHT CORRECTIONS.

As stated previously, one division on a sliding leaf corresponds to 3 yards at 1000 yards. By referring to sketch (No. 6), it will be seen that with a constant angle (α), at 1000 yards, $a - 1000 =$ 3 yards at 2000 yards, $b - 2000 = 6$ yards, etc. That is, the chord of constant angle (α) increases in proportion to the range.

For the telescope sight, where the reference is not divisions, the distance subtended by the vertical wires is used. As stated previously, it has been found that these wires subtend a chord 16 yards in length at 1000 yards range. That is, if it was desired to correct for an error of 8 yards at 1000, the target would be placed at the junction of the horizontal wire and a vertical wire. This correction, for convenience, will be taken as referring to speed alone. Since a ship moves $\frac{6086'}{60 \times 60} = 1.7'$ per second when going at a speed of 1 knot per hour, this correction of 8 yards must be for a speed of $\frac{24'}{1'.7 \times 1.83} = 8$ knots, since T 1000 (10" B. L. R. 1760 f. s.) = 1.83. Since the time of flight for 2000 yards is practically twice this (correct for an I. V. of 2000 f. s.), (3.83) and for 3000 yards 3 times (5.98), we may say "For a speed of 8 knots, *at any range*, place the target on the right (or left) vertical wire" (Sketch No. 7).

This would be true because the angle ($\frac{1}{2}\alpha$) subtends a chord of 8 yards length at 1000 yards, 16 yards at 2000 yards, and 24 yards at 3000 yards, and the times of flight increase in the same proportion. Suppose we take a vessel 48 feet long (see Sketch No. 7). At 1000 yards she would just fill the space between the vertical wires, at 2000 yards, two such vessels would be required, while at 3000 yards 3 such vessels (or one 144′ in length) would just fill this space. Therefore:

"Corrections for speed do not vary for changes in range." This rule applies to corrections for wind also. Taking the Navy Scale, the deviations * due to wind are as follows:

	Miles per hr.	Dvn at 2000 yds.
1. Light air	8	1 yard.
2. Light breeze	13	2 "
3. Gentle breeze	18	3 "
4. Moderate breeze ...	23	4 "
5. Stiff breeze	28	5 "
6. Fresh breeze	34	6 "
7. Very fresh breeze ..	40	7 "

* When direction of wind is perpendicular to line of fire.

That is, "the error in yards due to a wind blowing across the line of fire (range 2000 yards) is numerically equal to the force of the wind as recorded by the Navy Scale." For 1000 yards it would be ½ this, for 4000 yards it would be twice the amount. *This rule applies to large guns only, and at moderate ranges.*

IT IS NECESSARY TO KNOW THE RANGE EXACTLY.

(7) It is necessary to know the range exactly. Suppose the range was given as 2200 yards while it was 200 yards less, or 2000 yards. If the gun fired when the line of sight was on the target, the shot would pass 18 feet over.

Since we have no good method of finding the range in target practice, ships should be run on bearings so that ranges may be accurately given. (This applies to target practice alone.) In battle the best known method of finding a range is by using a small-caliber gun for short ranges and a large-caliber gun for long ranges.

Suppose that two ships are meeting, the range and speed correction must be determined with a large-caliber gun because it will be impracticable for individual gun captains to get their corrections later. No one can tell where his shot struck when all the guns are firing "at will," as there is no way of identifying the splash of any particular shot.

Having found the range, general rules would be:

Aim at the bow—

1. When a vessel is overhauling you.
2. Running away from you.

Aim at her stern—

1. When you are overhauling her.
2. When you are running away from her.

Aim at bow—

When two vessels are passing.

For rolling down (telescope sight)—

Fire when her masts are on the horizontal wire.

For rolling up—

Fire when her hull is above the horizontal wire.

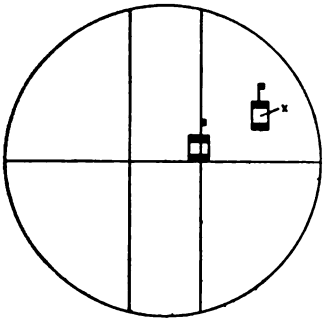
(These rules do not apply to large-caliber guns. They are for R. F. guns which handle easily.)

Since writing the preceding paper, it has been learned that Lieutenant-Commander Fletcher, U. S. N., found the average

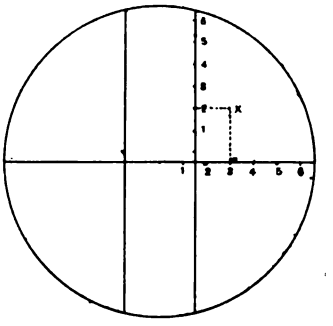
firing interval to be 3/10 second. The experiments were carried on at the Torpedo Station, Newport. This value (3/10 second), was found by making a man press an electric button at a given signal, the person giving the signal being either so placed or the signal being of such a nature that no advance information was given as to when the signal would be made.

It will be noted that what is termed the firing interval in this paper is different from the preceding, as well as from that defined in The Text-book on Ordnance and Gunnery—Ingersoll. The variable part—due to different men having different personal errors—and the constant part are not separated, and it is probable that the two combined make an interval of approximately 1/5 second, as stated.

As men gain experience and intuitively learn their corrections for this interval, their firing is improved and their mean error may be reduced to a small fraction of a second.

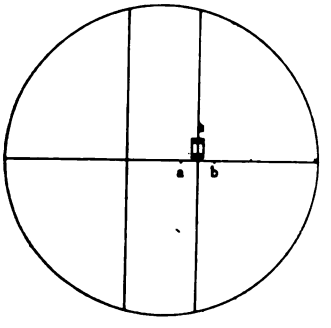


1.

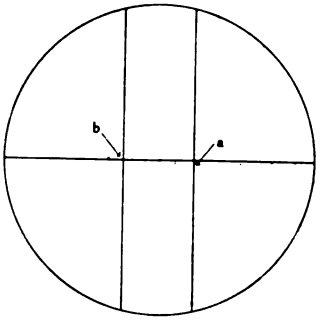


2.

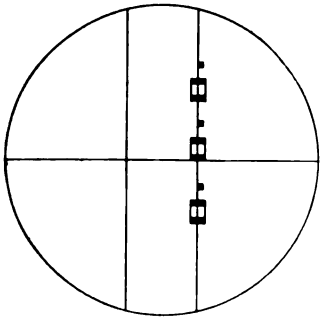
Horizontal, 1 Divn. = 5 knots speed.
All quadrants to be similarly marked.



3.



4.

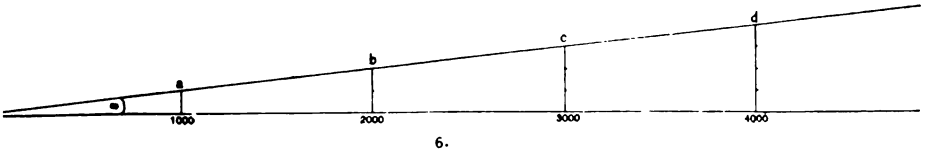


5.

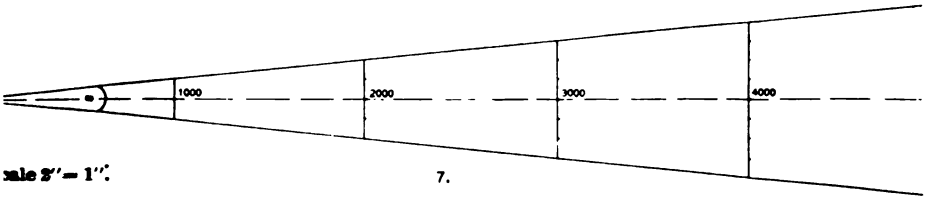
Position target when gun fires (down roll).

Position target when button is pushed.

Position target when gun fires (up roll).



6.



ale 2" = 1".

7.

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BRITISH CONQUESTS IN THE PHILIPPINES.

By Carlos Gilman Calkins, Lieut.-Commander, U. S. Navy.

The sordid incidents and insignificant results of the Philippine expedition of 1762 are briefly dismissed by general historians of the eighteenth century. Spanish and English writers follow the same policy of discreet neglect. Yet there were early pamphleteers who exalted the valor of the attacking forces—with a view to promoting their claim for pecuniary reward—and chroniclers of the provincial type still celebrate the devotion of the loyal Spaniards who bore a part in the defense. English admiration fell silent when the recovery of the Manila ransom was given up, but the local histories compiled to secure the propagation of loyal sentiments among Filipino schoolboys continued to invent and disseminate myths of heroic type throughout the nineteenth century. Now that Philippine conditions and antecedents have become a compulsory topic for American readers, it may be worth while to search the scanty records for parallels and precedents which may throw light on current problems. At the least, some curious illustrations of military method and political ambition in the past may be made accessible.

As a military event the Manila expedition once occupied a prominent place in the chronicles of the closing period of the Seven Years' War. Spain chose to enter the lists as a champion of the declining prestige of France under the Family Compact signed in August, 1761, to unite the Bourbon monarchs in a mutual effort to defend their exorbitant territorial claims in all parts of the world. The contest began in 1756 from the collision of French and English schemes of expansion in the valley of the Ohio and on the Coromandel coast. Before the end of that year

Braddock had been defeated, the English at Calcutta had been stifled in the Black Hole, and Minorca had been lost. These warnings made public opinion a paramount force in the conduct of the war, and a corrupt and incompetent administration was replaced by the installation of the elder and greater Pitt as virtual dictator. Under his firm hand and impetuous will the nation was organized for war, and British supremacy was vindicated wherever sea-power could control the issue. In 1759 the French navy was crippled at Lagos and Quiberon, and the capture of Louisbourg and Fort Duquesne, followed by the crowning victory at Quebec, put an end to the French dream of a North American empire. The next year's struggle wrecked French domination in India, and the last French army in Asia was routed in January, 1761.

The decision which led Spain to risk her colonial empire by coming forward as a belligerent was due to personal impulse as much as to public policy. The accession of Charles III in 1759 broke up the lethargy which had overtaken the court at Madrid during his brother's declining years. He had had to resent British threats against his Neapolitan cities in 1742, and he inherited Spanish bitterness over the loss of Gibraltar and English interference with the trade of the Indies. He appointed to his cabinet various ministers of foreign extraction; Wall, an able Irishman, was moderate or favorable to England, and soon sought retirement; Grimaldi, a Genoese, "was more French than any Frenchman," and stimulated his master's eagerness to check the growth of a power which was ruled by the purpose of seeking "expansion on land and despotism at sea." France had to be saved from the harsh measures of an "insulting victor," and enabled to keep her colonies and to maintain a navy. Spain felt that her own vast pretensions were threatened by the arrogant policy of Pitt.

In England personal influences due to the accession of a new monarch seemed to make for peace. George III, the first English king of the Hanoverian line, fell into the hands of Lord Bute, a clumsy Scotch courtier, and strove to shake off the domination of Pitt, who asserted himself as tribune of the people, as the representative of public opinion in the royal council. As prime minister he was wont to threaten his dilatory or incompetent colleagues with immediate impeachment if supplies and

troops were not ready to meet the demands of his policy. Anson sat in the cabinet as first lord of the admiralty, but he was forced to sign naval orders which he was forbidden to read. Such pressure was bound to cause reaction, and Pitt was forced out of office in September, 1761. It was reckoned no small victory for the young king and his courtiers when they got rid of the ablest war minister who has ever served England, just as he was bringing the war to a triumphant close. So much was accomplished during the first year of George III.

Pitt fell because he was impatient to begin the contest with Spain. In July, 1761, a French negotiator came to London with proposals for peace. He astonished the English cabinet by presenting demands and threats on the part of Spain—the agent of a belligerent claiming to represent a neutral power hitherto on friendly terms with England. Pitt urged the despatch of a fleet to Cadiz, where a treasure fleet was due, as a direct answer to Spanish threats. The council refused to act, and when Pitt spoke of his responsibility to the people he was told that all who sat at that table, Pitt as well as his colleagues, were responsible to the king only. This forced Pitt to resign, and his failure to appeal to the public was followed by an unbecoming acceptance of royal favor which cost him his popularity for the moment. But his plans for invading "the most assailable parts of the Spanish dominions" were executed by officers whom he had selected to command the forces prepared for expeditions beyond sea.

The view opposed to Pitt's policy was thus expressed by the Duke of Bedford, a member of the cabinet in 1761: "If we retain the greater part of our conquests out of Europe we shall be in danger of overcolonizing and undoing ourselves by them as the Spaniards have done." Moreover, the attempt to annihilate the naval power of France would unite all maritime nations against the English as seekers of a monopoly "at least as dangerous to the liberties of Europe as that of Louis XIV." Still tamer views were expressed by Rigby in correspondence with the duke: "I should not be sorry to hear that Martinique or the next windmill you attack should get the better of you." This is an un-English note, but the party of moderation was not destitute of foresight in opposing aggression or in making easy terms for the allies when the struggle was over. Dr. Gardiner, the greatest of English historians—because he is the fairest—

cannot regret the eclipse of Pitt: "He would have given England that dangerous position of supremacy which was gained for France by Louis XIV in the seventeenth century and by Napoleon in the nineteenth century. He would have made his country still more arrogant and haughty than it was, till other nations rose against it." It was Pitt's love of war rather than his skill in carrying it on that was in question. Before Pitt left the stage he rose to protest against the arrogance shown in dealing with the American colonies, though he was the last to admit the inevitable results of Spanish and French intervention in support of their independence.

As soon as the treasure ships were safe in port Spain threw off the mask, and war became a necessity. Portugal was threatened with conquest if she held to the English alliance, and some of her provinces were overrun. This invasion was not arrested without the help of English and German officers trained in the wars of Frederick the Great, who was fighting France and Austria throughout this period with results which need not be discussed here. The English declaration ushered in the new year, 1762, and Charles III replied a few days later. Whatever one may think of his arguments, no fault can be found with his command that his subjects throughout the world should be warned to protect themselves from the incursions of the enemy, and to do him as much harm as lay in their power. But we shall see that this obvious precaution was neglected, and the colonies were taken unawares.

The year opened auspiciously for England, and her progress toward maritime supremacy was unchecked by her new antagonist. Martinique was taken from the French in February, Havana surrendered in August, and Manila fell in October. France resumed her efforts to negotiate, and Spain accepted the conditions imposed by the victor; the preliminaries were signed in November, and the Treaty of Paris was confirmed early in 1763—long before any report of events in the Philippines had reached either London or Madrid.

There were manifest reasons for the choice of Manila as the object of attack. Spain was never strong in the Far East, having always been negligent or incompetent in the maintenance of sea-power. Moreover, it was reckoned that less than one-third of the inhabitants of Luzon were in subjection to Spain, and it

was well known that all her colonies were oppressed and discontented. These facts furnished support for political schemes, and there was no lack of commercial calculations and strategic speculations: "For Manila in the possession of an enterprising people is capable of ruining the whole China trade of any other, as the port of Cavite can build, fit out, and man very large ships of war, which, if properly stationed, no vessel could possibly escape, unless protected by a squadron." Again, "with Manila in our hands we might depend upon respect to our flag in the ports of the Chinese Empire." Great Britain had to send out better ships than were ever built in the Philippines and hold more convenient naval stations than Cavite before the Chinese policy of exclusion was overthrown. Shipbuilding in the ports of Luzon had been carried on for centuries before the English visit, but no vessels capable of suppressing piracy in the archipelago or escaping English corsairs in the Pacific were ever produced. Yet such were the motives for this enterprise, "exclusive of the popular and dazzling notions of booty and plunder." The influence of such notions appears in the stipulation which gave the East India Company one-third of the value of all plunder taken by the expedition in return for expenses incurred in providing equipment. This curious contract seems to have returned a fair profit to that rapacious mercantile monopoly, which had begun to seek profit through a policy of conquest.

The expedition seems to have been planned with some care; it appears that the officer chosen to command the troops had visited Canton in a frigate during 1759 for the purpose of securing information concerning conditions in the Philippines, obtaining certain general notions already cited (Annual Register, 1763). He afterwards claimed to have planned as well as executed the enterprise. This officer, Sir William Draper, was made a brigadier for this expedition and received knighthood as his chief reward for its success. He was born in 1721, entered the army in 1744, after receiving a classical education at Eton and Cambridge, married the granddaughter of a duke—a descendant of Charles II—in 1756. All these circumstances had their influence upon his career in the service. In 1757 he was appointed to command a new regiment, the 79th, recruited for the campaign in India. After serving with credit in the contest with the French in that country and visiting China and England he ar-

rived at Madras in June, 1762, to assume command of the Manila expedition.

The naval force detailed to convey the troops to the field of action and to support them in the attack was commanded by Admiral Cornish—who had to accept a baronetage in lieu of other rewards. His squadron included seven ships-of-the-line, besides frigates and storeships—an ample force, considering that no naval resistance was anticipated. The admiral took measures to intercept the enemy's despatches by sending a frigate to watch the Straits of Malacca, and another sailed for Manila to take soundings and make a reconnaissance, completing the work a few days before the arrival of the fleet. The absurd weakness of Spain appeared in the fact that this frigate was able to make this visit without explaining her purpose or admitting any official intercourse with the puzzled authorities, who were unaware of the declaration of war published from Madrid eight months before. Rumors from Batavia had been slighted, but the apparition of a mysterious cruiser led to an effort to fit out two or three vessels to secure the safety of the annual treasure ship then due from Acapulco. But this measure was not destined to take effect.

The evening of September 22 saw a British fleet of fifteen sail standing in for the anchorage north of Sangley Point. There had been delays in embarking stores and troops through the surf at Madras, and some anxiety lest the southwest monsoon might fail before the voyage was completed. But the run was fortunate, and the seamen had now to arrange to land their passengers through another line of surf on the beach below Malate. The acting governor-general of the Philippines lost no time in sending an officer to inform the English commander of the surprise caused by the presence of the fleet. The reply was delivered at the palace without delay: "The King of Spain having declared war against England, the squadron had come to conquer the city and the Philippine Islands, and that if the Spaniards were unwilling to undergo the rigor of war, they should surrender without delay." Of course, the answer was a protest against the harm that might ensue, "since the faithful vassals of the King of Spain were bound to shed the last drop of their blood rather than surrender without the royal order." It was added that the Spanish forces were in nowise inferior to those afloat, as their vigorous defense should demonstrate.

Whatever the Spanish power of resistance might be, it was in the hands of an incompetent authority. The governor-general was the Archbishop of Manila, Don Manuel Rojo, holding an interim appointment from the king. The courts had assigned the succession to a bishop, but the royal decree designated the higher prelate to assume the post left vacant by the death of General Arandia. The popular histories circulated in the islands describe the archbishop as "a feeble and irresolute American," whose weakness delivered the archipelago to the English. A more judicial writer credits him with "more energy than might have been expected from a man of his profession." But all his energies were bound to prove ineffectual.

The English force available for attacking the city included 1300 European troops—some of them Frenchmen from the army disbanded after defeat in India, about the same number of Sepoys of inferior quality, 700 seamen and 300 marines from the fleet. The defense could dispose of some 500 men of the Regimiento del Rey, a few artillerymen, 300 Spanish militia, and an unlimited supply of eager but undisciplined natives, Pampangos and Tagalos. As the town was left open until it surrendered, supplies and reinforcements continued to enter.

The first effort made by either party related to the stone fort of San Antonio Abad, a structure familiar to many Americans in 1898. Powder was manufactured in this work in the last century, and the name *polvorin* stuck to it long enough to provoke inquiries and reports from our consul prior to the advent of Admiral Dewey's fleet. But in 1762 there was really a store of powder, most of which was removed before the English landed. There was much debate as to whether the rest should be used to blow up the battery or to fight its guns. The party in favor of fighting won the vote in council, but the detachment sent to man the works arrived too late. The English landed on September 23, and lost no time in occupying the fort and exploring the adjacent suburbs. The belated garrison of San Antonio and other stray detachments were promptly driven in until everything along the beach was abandoned, the English advancing through Malate and Ermita, and the Spanish retiring within the walled city. North of the latter suburb lay two villages grouped around the massive churches of Santiago, which stood near the beach, and San Juan de Bagumbayan further inland. At some

later period these masses of buildings were cleared away to make the present promenade which the Filipinos call the field of Bagumbayan—and might call the field of blood, since it was stained with the murder of Rizal and other patriots in 1896 and 1897. But the English attacking force found cover in the houses, and made fortresses of the churches, both of which appear to have stood within 500 yards of the city wall.

In advancing their batteries the English frankly disregarded the strict rules of attack as understood in those days of ineffective artillery. They found the enemy slack and unready in his plans of resistance. Nothing had been attempted while the invader was landing his troops, but sorties were ordered after he had found cover in stone buildings close to the walls. These sorties were made at night whenever a body of Filipinos could be stimulated to undertake them. The first was made on the night of September 25. The Spanish detachments withdrew, but "firing lasted all night without much results for anybody," a phrase which recalls the summer nights of 1898. Another useless sacrifice occurred two days later, but the grand and final attempt took place on the morning of October 3. Three columns, containing altogether 2000 Pampangos and 200 Spaniards, sallied forth before daylight, but their shouting and beating of drums made a surprise out of the question. The attack was vigorous, however, and the English—or rather the Sepoys—were driven from the church of San Juan. The natives climbed the tower and began to ring the bells. The besiegers rallied and drove back their assailants. Had the natives had skilled leaders and better arms, a temporary victory might have been won by hand-to-hand fighting.

The impression produced upon the minds of English officers deserves our notice: "It is somewhat remarkable that the Asiatique Indians of the peninsula of Malacca, and, in general, of all the islands, should differ so extremely from the Chinese and every other nation of the Eastern Continent. The former are as distinguished for their fierce valor and for a singular contempt of death, as the latter have always been for their cowardice and for the softness and effeminacy of their manners. In our wars on the Indian Continent, the European troops were almost the only object of attention. In our attack upon the Philippines, the natives were at least to be equally dreaded. In this sally, had

their discipline or their arms been at all equal to their strength and fierceness, the issue of the event had been very doubtful." It is to be remembered that these are the words of Edmund Burke, based on the reports and opinions of General Draper.

The English lost about forty men in this night attack, and the Spaniards seventy. As for the Filipinos, no quarter was given, and some hundreds were slain, all prisoners being hung at once. This atrocity seems to be associated with the slaughter of a British officer under a flag of truce by a band of natives close to the walls of the city. Draper had already warned the archbishop that obstinacy might lead to barbarity on the part of some of the English troops who might not submit to restraint. It is to be assumed that he meant the Sepoys, though the phrase had a wide application in both the hostile armies.

By this time the English had a breaching battery of 24-pounders playing on the south bastion, and a group of mortars behind the church at Santiago, throwing shells into the city. The admiral placed his flagship opposite the southeast bastion, and stationed other vessels off the mouth of the Pasig to fire at Fort Santiago, the citadel on the river bank. The fleet had to lie in deep water, and its solid shot were ineffective when fired at high angles. The Spanish had plenty of guns—most of them cast at the foundry (*fundicion*) which gave its name to the southeast bastion—but their return fire was altogether ineffective. They seem to have neglected the ships while trying to keep down the fire of the siege batteries. But the breach was widening day by day, and many guns were dismounted along the wall. Since the failure of the last sortie, the defense grew hopeless: "Any other people but the Spaniards of this garrison would have capitulated, or would have posted men to resist storming." Their pretended resolution was nothing but "sullen obstinacy, uninspired by a true military spirit, as it was wholly uninformed by any true military skill." Yet the archbishop consulted his council daily, hearing the advice of the courts and the clergy as well as that of officers and engineers.

On the morning of October 6, the breach having been reconnoitered and found practicable, a storming party of 400 men was led forward by Major Fell. They found the breach unguarded, and were able to advance up the Calle Real without opposition, halting to clear the cross streets and silencing small-arm fire from

the houses by shooting or bayoneting their occupants. One group of a hundred is mentioned as thus throwing away their lives. The archbishop and his council, as well as most of the Spanish troops, were shut up in Fort Santiago. Consent was refused when it was proposed to fire a field-piece down the street against the head of the advancing column. The day before the assault, an order was issued by the commandant of the garrison warning the monks to forbid the natives from manning the walls. The officer commanding the king's regiment ran off, followed by most of his men. The only hero of the defense was an Irish pilot, Raimundo Kely, as the name stands in the chronicle, who died bravely in the Carranza bastion. Some hundreds are said to have been drowned in the Pasig during the panic which preceded the capitulation.

The governor lost no time in sending out his terms of surrender. These being found unsatisfactory by General Draper, the archbishop and his general were summoned to leave the fort and present themselves at the palace where they were forced to accept whatever the English chose to offer. The archbishop had asked for the free exercise of religion, protection for life and property, the honors of war and back pay for the garrison, free trade between the city and country, and the maintenance of ecclesiastical and civil government on the existing basis. For these favors he offered a ransom of $1,000,000.

The English terms made the officers prisoners on parole, required the surrender of artillery and ammunition, of the port of Cavite and all forts in the island. The privileges demanded would be allowed upon payment of $4,000,000, half in cash and the rest in valid drafts. It is said that threats of general slaughter were employed to enforce acceptance of these terms. At any rate they were signed, and the city was delivered to the English on October 7.

In spite of all promises, pillage seems to have followed the English occupation. There is the usual tale of atrocities, houses plundered and all that could not be removed destroyed, women mishandled, churches desecrated and stripped of plate and vestments. It is all only too probable, but the Spanish writers admit that it was over in three hours, that the English soldiers were rather predatory than cruel—though the Sepoys are said to have amused themselves by inflicting tortures—and that Chinese robbers were

put to death, Draper shooting one of them himself, and directing the hanging of two more. The public archives and much private property were burned. In all forms of mischief, the native servants and the levies of Pampangos and Tagalos were foremost. When Draper decided to banish all Filipinos from *Intramuros* the suburbs were likewise looted. There is said to have been a renewal of license on the second day for a fixed period, and sporadic cases occurred until the invaders withdrew. The port of Cavite was delivered to the English after the natives had been allowed to pillage the arsenal. With all the license granted the conquerors, there was plenty of soldierly grumbling: "The General's Latin cost us our looting," growled those who had heard that the capitulation was drawn up in the language befitting a churchman and a scholarly commander-in-chief engaged in diplomacy.

The political attitude of the British and their relations with the Filipinos must now be considered. The first statement of their intentions appears in a joint proclamation from Draper and Cornish, issued from H. B. M. S. Norfolk, on September 24. The natives were warned against assisting the Spaniards, and were offered protection and relief from the heavy taxes imposed upon them; "we are here to deliver your country from ruin and your wives and daughters from dishonor." A promise to pay fair prices for all stores brought in was, perhaps, of more practical effect than any assurance that the English had come to relieve the natives from toil and to make war on the Spaniards only. After some opposition on the part of the Spanish authorities the archbishop and magistrates were made to sign a deed of cession, transferring the whole of the Philippine Archipelago from Spain to Great Britain. Circumstances prevented any decision of the validity of such an instrument, but the Spanish community seems to have refused obedience to the governor's order that the British domination should be accepted.

Incessant annoyance was the fate of the Spanish officials charged with the collection of the two millions due as a part of the ransom. The immediate demand for a million was met by the payment of only $700,000, raised by a general contribution, which stripped merchants of their goods and churches of their plate and ornaments. The annual galleon from Acapulco was due, when the place capitulated, with silver to pay for the Chinese

goods which had made up her eastward freight and coin for carrying on the government of the Philippines, which was then dependent on Mexico. The treasure ship was the Filipino, and stipulations were made for the payment of the ransom from the bullion on board. But the silver was landed before it could be secured, and the ultra-patriotic element which had taken to the jungle refused to allow it to go to Manila when the archbishop sent orders to that effect.

Early in October the ship Trinidad, outward bound from Manila, was captured by two frigates and brought in as a prize. Her cargo showed that she was freighted for Mexico, and there was little money on board. She was pierced for sixty guns, but only six were mounted. During the action she had relied on the thickness of her sides to keep out the enemy's shot, and had made little effort to return his fire. Heavy tropical timber was used in all ships built in the Philippines, making them sluggish sailers, with considerable defensive strength. These conditions had regulated naval tactics in the seventeenth century when the galleons were threatened by the Hollanders or by English buccaneers, but they had failed to save the famous prize taken by Lord Anson near the entrance of San Bernardino Strait. The Trinidad with her cargo was appraised at $3,000,000, and she was purely a naval prize. Yet the Spanish authorities tried to set off her value against the unpaid ransom, and recent writers persist in confounding her with the Filipino to sustain that theory. The richest prize of 1762 was the Hermione, taken off Cape St. Vincent with $5,000,000 in treasure at the completion of her voyage from Lima. This capture gave a handsome fortune—for that age—to the captain, and each of his officers won a competence.

Five weeks after the capture of Manila, General Draper turned his conquest and its coming problems over to a Mr. Drake, who was appointed as deputy governor as an agent of the East India Company. The garrison was commanded by Major Fell, and a naval officer was governor of Cavite. Sailing from Manila with the northeast monsoon on November 11, Draper reached London on April 4, 1763, making the run in the remarkable time of 144 days and bringing the first news of his conquest—news which had lost all importance and most of its interest through the negligence of the ministry in its "headlong eagerness for peace." Draper seems to have been promised the next red ribbon of the Order

of the Bath, and he secured some honor at Cambridge by presenting the Spanish standards captured at Manila to King's College, of which he had been a fellow. The banners were carried in procession and fixed to the altar rail of the stately chapel of that college, where they are still preserved. The general built a mansion near Bristol and named it "Manila Hall," but he did not outgrow his grievance over the loss of the ransom, nor did he develop a capacity for dignified retirement.

The Treaty of Paris (January, 1763) took no account of the Philippine situation because of the "shameful omission of any provision relating to conquests made and not known before preliminaries were signed." Such omissions are still made, however, in spite of historic warnings. In the matter of conquest England was not in an exacting mood. France gave up the right to keep up a military establishment in India, and ceded Canada to Great Britain and Louisiana to Spain. Cuba was restored to Spain, and Florida went to England in exchange. Thus the North American continent was freed from any power capable of interfering with the progress of the thirteen colonies, and the connection with Great Britain ceased to be of vital importance to those communities. Martinique and Guadeloupe went back to the French, much to the disgust of Pitt, who insisted that England should hold these islands for the sake of exclusive trade: "All that we gain on this system is made fourfold to us by the loss which ensues to France." This ill-tempered notion has been long rejected by England, though France seems inclined to let it pervert her eager colonial policy in Madagascar and elsewhere.

Among the irritating claims put forward by England as the result of her maritime supremacy was one restricting the trade of neutrals with the colonies of a belligerent. Only the usual commerce carried on during peace was tolerated, and neutral property under a neutral flag might become lawful prize when captured on the high seas without regard to blockade or to the character of the goods. Thus, the French effort to enable colonies to sell their products was defeated by decisions referring to restrictions imposed on the trade of her colonies previous to the declaration of war in 1756. Forty years later this harsh rule was applied to destroy American commerce in the West Indies. English and American authors seem to admit this principle as a part

of marine international law, though continental jurists oppose its acceptance. If it has to be admitted, the best remedy for possible hardships in its application to remote possessions would seem to lie in the removal of restrictions during peace. Thus, the extension of some sections of our navigation laws to oversea possessions would cripple commerce during a contest with a maritime power.

There was no lack of exasperation against England's belligerent claims and methods in 1763. Spain had succeeded in taking the Portuguese colony of Sacramento on the Rio de la Plata when she was called upon to resist a buccaneering attack upon Buenos Ayres. This is the story as printed in the "Annual Register": "Having made ourselves masters of the Havana, and taken measures for the conquest of the Philippines, it was judged expedient to encourage some private adventurers to add to our other operations against Spanish commerce an attack upon the colony of Buenos Ayres." Captain Macnamara, "an adventurer of spirit and experience," was made commodore of the squadron, and was defeated and slain with most of his mixed company of Portuguese and English on January 1, 1763, his flagship being sunk by Spanish guns. Other vessels of his fleet brought home intelligence of the failure of this tardy and discreditable enterprise.

The episode of the Falkland Islands showed the irritation produced by these attacks. Lord Anson had indicated the value of these islands as a naval base whence Spain's domination in the Pacific might be threatened. When it was proposed to take possession in 1748, the Spanish ambassador, Wall, though favorable to England in general, had to announce that intrusion into the South Seas would be regarded as an act of war. Yet a garrison was sent out in 1765. Four years later Spain demanded evacuation, and in 1770 a Spanish squadron carried away the garrison as prisoners. Charles III had to disavow this act, and he nursed his resentment until the war of the American revolution gave him a chance to lower English prestige.

Great Britain had other motives for coming to terms with her foes than a regard for their future hostility. The draught of the king's speech, prepared by Bute, deplored "the bloody and expensive war," which was consuming the resources of the nation. The phrase was modified but the fact remained. No less than

110,000 soldiers, besides a large army of German auxiliaries, and 70,000 seamen were employed. The whole number of seamen enlisted or impressed during the Seven Years' War amounted to 180,000, of whom less than one-third were ever regularly discharged. Death and desertion are supposed to account for more than 130,000 of these recruits. Yet few had fallen in battle, though disease had swept away thousands under the walls of Havana. The appropriation for the last year of the war fell little short of $100,000,000, and the struggle lasted long enough to double the national debt—a result which was repeated twenty years later when the American colonies secured independence.

In spite of these burdens the national pride was offended by the tame acquiescence of the government in Spain's refusal to pay the Manila ransom. Pitt was the organ of such sentiment whenever he could score against his successors: "How can you depend upon Spain after the treatment she has shown to that brave and gallant officer, who has suffered for his lenity towards them at the Manillas and now feels their perfidy?" Conway and Grenville used similar arguments to annoy each other—each criticising the slackness of him who happened to hold office. Grenville was accused of becoming the advocate of Spain, but he said he only repeated their arguments by way of explanation.

The Spanish refusal was natural enough to dispense with elaborate arguments from the king's advisers. Grimaldi told the British envoys that the promise of a ransom in lieu of plunder was void because pillage was only an abuse in modern warfare. Moreover, the bonds were extorted by force—to which the reply was made that it was so with all the articles of any capitulation—and that, "in the same fashion, the Archbishop might have stipulated in the king's name for the surrender of the province of Granada." When he added, "My master would fight forever rather than consent to pay a single doubloon," a peaceful ministry had to drop the subject. Finally, Draper and Cornish were told by Lord Shelburne, then prime minister, that their rights had to be sacrificed to the public interest and to national convenience. Up to this time Draper had been as eager as the amount involved—$125,000 for the general and the same for the admiral—would suggest. He had published a pamphlet refuting the Spanish pleas, summarizing the case in the title: "Colonel Draper's Answer to the Spanish Argument Claiming the Galleon

and Refusing Payment of the Manilla Ransom from Pillage and Destruction," (1764).

Unfortunately for Draper, he could not confine his literary talents to appeals of this nature. In 1769 the shadowy Junius—Lord Temple is now the favorite among those concerned in conjectural identifications—began his career by an attack upon the commander-in-chief, the Marquis of Granby. Army reform is a topic of perennial interest in England, and Junius created something of a sensation. Draper, vain of his scholarship and of his intimacy with Lord Granby, a "fatal friendship," Junius called it, undertook the defense of his chief, with the usual apparatus of classical quotation and invective. Lord Granby was charged with selfishness in providing for his family by promotions and favors. His advocate had no patience with this: "How are any man's friends and relations to be provided for, but from the influence and protection of their patron?" Junius had mendaciously called this being "generous at the public expense."

But the unknown promptly turned his weapons from Granby to Draper, who found himself accused of "servile submission to the reigning ministry" and of selling the companions of his success. He was urged to reveal his motive for betraying his fellow soldiers: "Was it the blushing ribbon which is now the perpetual ornament of your person?" Draper replied that ministers had told him that "they could not think of involving this distracted nation in another war for our private concerns." "Although I may lose five and twenty thousand pounds by their acquiescence in this breach of faith by the Spaniards, I think they are in the right to temporize, considering the critical situation of this country, convulsed in every part by poison infused by anonymous, wicked, and misleading authors." Junius, always well informed about the affairs of the army, brought up a transaction by which Draper had effected some sort of exchange—apparently not profitable to himself—and asked spiteful questions: "Was it decent, was it honorable in a man who pretends to love the army to make a traffic of the royal favor and turn the highest honor of an active profession into a sordid provision for himself and his family?" Draper could find no rhetoric adequate to his opponent's crimes, and had to fall to challenging him to drop his mask and fight a duel. Of course Junius made it obvious that an anonymous writer was not bound to reveal him-

self to every antagonist whom he defeated in argument, and the veil was never withdrawn.

Draper became a major-general in due course and a lieutenant-general before he died. He travelled in America, and formed a colonial connection by marrying as his second wife a Miss De Lancey of New York, who got an Irish pension in spite of the wealth of her family. To this connection may be attributed the rumor that Draper was to go out as second in command in America in 1774, when Walpole noted him as "writing plans of pacification in our newspapers." Instead of attempting the execution of futile schemes in America, he took the post of lieutenant-governor of Minorca, and endured the siege of 1781-2. England could not afford to relieve the place, her forces being fully occupied in threatening America and holding Gibraltar. The island was offered to Russia as the price of an alliance. Finally it was surrendered and made a permanent possession of Spain. Upon his return to England Sir William Draper preferred twenty-nine charges against the governor, General Murray. All but two of these charges were held to be "frivolous and ill-founded" by the court-martial, which dictated mutual apologies for the two generals. Murray was obstinate. Draper, "though the greater Bedlamite," according to Horace Walpole, signed submissively. He had also to endure a royal reprimand for his factious conduct. As a man never at a loss for grievances, he appealed for further recompense, stating that his position at Minorca, his share of the Manila ransom, and his wife's fortune—confiscated by the Americans on account of the loyalty of her family—"had all been sacrificed to save the country further effusion of blood and treasure." With his claims still unsatisfied, Sir William Draper died in 1787.

For the Manila ransom, Spain never made a better offer than that of leaving it to the arbitration of Frederick the Great—an offer unacceptable to England. Before the end of the century, a Spanish historian of the Philippines spoke of the matter as buried in oblivion, "covered by the millions sacrificed in the treaty relating to Nootka Sound and the whale-fisheries on the northwest coast of America." Yet a dim notion that England had some sort of a lien on the Philippine Archipelago was found prevalent in Hongkong in April, 1898.

It is time to return to Manila, and to consider the state of the

derelict provinces of Luzon during the miserable period of anarchy which lasted eighteen months after the formal suspension of hostilities in Europe. There was no lack of rival authorities and contending jurisdictions during this unhappy interval. In Manila there was an English governor, whose pretensions were opposed by successive military commandants, the last of them describing Governor Drake as "ignorant of every branch of military service, custom, duty, or order." So much seems to have been proved, and there are accusations of much that was worse than ignorance. As a convenient agency for disseminating the decrees of the British rulers, the archbishop and his council were guarded in the capital, and made to assert a spectral authority. Then there was a judge of the supreme court roaming about the adjacent provinces, carrying on guerrilla warfare, and calling himself governor and captain-general.

This troublesome personage was the notorious Don Simon Anda y Salazar, whose legend is recorded on the monument, now familiar to so many Americans, on the promenade outside Fort Santiago on the bank of the Pasig. The legend is amplified in various works printed for use in the Philippines; the school history credits "this vigorous and prudent old man" with nothing less than reconquering the island. The "Official Guide" says that he showed the British army how hard a task it was to subdue lands "sheltered under the shadow of the Spanish flag." With the aid of friars who preached the holy war and natives who rushed to join the improvised armies, led by their pastors, the situation of the English became so desperate that they were lucky in escaping from "a country which had cost them so much blood, and in which they dominated no more soil than they stood upon." It may be profitable to examine the facts relating to the elements of this truculent tradition.

Anda quitted Manila shortly before the surrender in October, 1762, in a "frail skiff," carrying $5000 in silver and a couple of quires of stamped paper—always an essential of Spanish sovereignty. As the city was not beleaguered, there was no difficulty in escaping. Professing to interpret the law, being the only active member of the court outside the enemy's control, Anda declared himself governor-general, alleging that the archbishop's surrender was equivalent to abdication. Possibly he had the law on his side; questions of succession in Spanish colonies

are too intricate for lay discussion. In fact, the courts were in difficulties over most vacancies in the Philippines. One rule has been settled during the present century; Rear-Admiral Don Patricio Montojo relates in his autobiographical novel, "Leon Aldao," that he had to correct Lord Elgin's impression that a prelate might become a governor, when the English diplomatist visited Manila about 1860. The main object of Anda's assumption of authority was to nullify the deed of cession for the whole archipelago which the archbishop had been forced to sign. To make this cession effective, letters were sent out from Manila, urging all officials and the clergy to render obedience to the English government until peace was made. Even private persons and natives received such letters, bearing the signature, "Manuel, Archbishop-Governor and Captain-General of the Philippine Islands." The unhappy prelate retained his titles throughout the year 1763, and no solution could be found for the conflict of authority until he died in January, 1764.

The English troops began operations to extend their conquest in November, 1762, by sending out a flying column to seize the town of Pasig as a base of operations for controlling the provinces of Bulacán and Laguna. The place was carried after some resistance, in which the Sultan of Sulu and his son, held captives by the Spaniards, bore their part. The town was intrenched with the convent as its citadel, and the post was held until the evacuation of the island, a fact showing the weakness of the Spanish organization for checking invasion.

Hearing that the town of Bulacán was to be fortified as Anda's capital, the English commander sent out a force to attack that place in January, 1763. The column embarked in boats to the number of 1800, 400 English soldiers and 300 Sepoys with a following of 1100 Chinese, 600 of whom are said to have been armed with pikes or bolos, the rest serving as porters. After landing at Malolos, where a small garrison was left, the main body marched to Bulacán. There the church and the adjacent cloister were found intrenched and guarded by seventy Spaniards and 1500 Filipinos with five small cannon. Busto, the most active of Anda's officers, his so-called lieutenant-general, was busy in annoying the English outposts and threatening the lines of communication. Three storming parties went forward before the convent could be carried. The guns were silenced,

but a brisk fire from musketry and bows preceded the hand-to-hand struggle in the church. The alcalde of the province, a Recoletan friar, and several Spaniards were slaughtered. Spanish writers—no others report this affair—accuse Major Slay, the English commandant, of turning a number of the wounded over to his Chinese followers, who finished them with tortures. The English troops spent nearly three weeks in Bulacán, where they were joined by the garrison left at Malolos. Then the column returned to Manila.

Busto collected bands of natives, and annoyed the detachments sent out to forage and the pickets in the suburbs of the capital. Much skirmishing went on over the church bells of outlying parishes, the Spaniards trying to carry them off to be cast into field-pieces and the English fighting to bring them in as trophies. Much marching and countermarching was done to secure the treasure from Mexico, which had been landed on the south coast of Luzon from the galleon Filipino. It was moved from one convent or cave to another, and the friars and guerrillas kept it from falling into the hands of the English, though Captain Backhouse stated that he was on the point of capturing it at Lucban when he was recalled to Manila by a senseless order from the governor. The captain had to fight, occasionally with the enemy a hundred to one, but throughout most of his marches in the provinces of Laguna, Batangas, and Cavite he found the natives ready to acknowledge King George as their sovereign.

While these operations went on in the field, a more virulent and persistent warfare of proclamations and menaces was waged between Anda and Drake, representing the militant authority of Spain and Great Britain respectively. One month after the capitulation, the Filipinos were warned not to obey Anda, who had broken its articles and was therefore declared a rebel against both sovereigns. Filipinos who lived peacefully were promised protection and liberation from Spanish oppression, but otherwise they would be treated as rebels. It is reported that Governor Drake offered a reward for the delivery of Anda, "alive or dead," and it is certain that Anda offered $10,000 for Drake or either of his councillors under the same conditions, denouncing them as "tyrants, common enemies, and unworthy of human society," epithets not unlike those

which greeted the invasion of 1898. But, in the eighteenth century, the British and Spanish vocabulary was alike in ill-tempered violence.

There were other influences tending to make warfare malignant, which must be presented in the words of a Spanish writer, the Marqués de Ayerbe, whose narrative is based on a contemporary manuscript. After noting that some friars had stirred up the natives against their masters, he adds the following: "On the other hand, some friars, exalted by patriotism, got rid of their tonsure, changed their monastic habits for uniforms, and, having themselves called generals or by other titles, came into the regions adjacent to Manila and Cavite, leaving nothing in the way of supplies on the estates, under the pretext of thus depriving the enemy, the fact being that, though the other side might receive some damage thereby, much more harm was heedlessly done to the Spaniards, and especially on account of the sort of people who made up these bands, since the greater part of them had been prisoners in the jails as robbers and highwaymen. It is sufficient to note what they did with a poor curate of the Company of Jesus, whom they maltreated horribly and came near hanging, because it was pretended that he was a traitor who supplied the English, pulling down the house of the Jesuit Fathers when they set him free. The sober and judicious part of the friars could not behold without great pain all these excesses, and they tried to assert themselves, punishing as they might those who were guilty, but for lack of force it was impossible to find a remedy."

It is not surprising to learn that the English dealt roughly with those members of the religious corporations who fell into their hands. The Augustinian convent in Manila was pillaged, and the prior was kept in solitary confinement. The friars connected with the University of Saint Thomas and the College of Santa Cruz were also arrested. The usual charges were those of inciting soldiers to desert—there were many Frenchmen in the detachments from India—sending intelligence to Anda, or receiving letters from him. For the latter offense one of the judges of the supreme court was tried by court-martial and sentenced to death—a fate which he escaped by paying $3000 to the British governor with a promise to make up $10,000 in all. This sordid fact is a matter of record, since the money was

returned in 1764 through the efforts of officers more scrupulous than the governor. Other extortions were practiced through the agency of petty courts established in Manila. Spaniards and natives of all classes were charged with sedition, heavy penalties were awarded, and the victims were ransomed for cash or jewels. Thus the medals and trinkets worn by Filipino women were collected by officials. These details are derived from the testimony of a British officer in a letter to his superiors.

Naturally there was great demoralization among the Filipinos. Some asserted their good will toward the Spaniards, and helped them in seeking refuge in the interior, but even these generous persons were apt to seize opportunities for robbing or insulting defenseless wanderers, justifying acts of violence in the name of the King of Spain, and accusing the Spaniards of betraying the capital to the English. Others invoked the name of liberty, and it was noted that a few priests and friars preached sermons inciting the natives against the Spaniards (Ayerbe). Those in charge of rural parishes were in a most trying situation: "If they abandoned their flocks, it was said that they allowed the fire of rebellion to spread; if they staid at home they were deemed accomplices, if not killed on account of respect or because a confessor was wanted" (Zúñiga).

The natives who lived near Manila were no less troublesome to the English than those in outlying provinces were to the Spaniards. In summing up the losses of the invaders, allowance was made for those cut off by the inhabitants, "who availed themselves of the slightest carelessness on the part of the English soldiers to assassinate them, and whenever a straggler or a drunken soldier was found he was put to death and buried." Padre Zúñiga shows the origin of a disposition to commit such atrocities: "The religious orders had cooperated very considerably with Señor Anda, in enabling him to maintain the Indians of the respective districts in obedience to his orders, by inspiring a horror of the English as enemies of the King and their religion, exciting them even to die in fighting cheerfully against them." But the exactions of the British, combined with severities ordered by Anda, would account for

a general dissolution of social order. The garrison was bound to have supplies and was willing to pay for them; the Spaniards killed all who were caught trading with Manila; any native found with rupees in his pocket was doomed.

But the Filipinos had political aspirations as well as predatory instincts, and the rebellion of the Ilocans deserves separate treatment. The alcalde who ruled the region around Vigan had harassed the natives by his activity and his avarice, "the ordinary vice of alcaldes," until the province was ripe for rebellion. The news of the fall of Manila was followed by contradictory injunctions from Anda and from the archbishop, to whose party the alcalde was inclined. Anda fiercely threatened the punishment of traitors for those who communicated with the English or with the archbishop while he remained in their hands. The natives began to form camps and take arms on the pretext of repelling invasion, and they were ready to cast off allegiance to Spain as soon as a leader came forward.

The man of the hour turned out to be Diego Silán, born in Pangasinán in 1730. He had served in convents during his youth, and was familiar with pious practices and mystical terms, which were of great use to him in his career as a revolutionist. He had been shipwrecked among savages, and was reckoned somewhat of a magician. He took up the business of carrying letters and parcels between the capital and the northern provinces. His journeys gave him a wide circle of acquaintances, and his fidelity to his charge made him a man of importance. The levy of Ilocans was made on the pretense of defending the province from the British attack. No more tributes were to be paid to Spanish officers because they had failed to guard the country. The arrest of the meddlesome alcalde was followed by the imprisonment of a bishop and a number of friars, and by the pillage of convents. The purpose of the rebels was declared to extend to the liberation of the natives from oppressive taxes and forced labor and the expulsion of all Spaniards and *mestizos*. Silán took the title of chief-captain, reserving that of general for "the Nazarene Jesus." His officers were commissioned to serve in "the guard of the royal banner of the sacred peace of the Christian prince" of that name, and all his orders were full of mystical confusion. It is to be noted

that he was not a native of the province which yielded to his assumed authority, and it is plain that the people must have been ripe for rebellion.

Anda sent a missive from Apalit, summoning Silán to cease his rebellion; otherwise, "I will send the Catholic army to subdue the province with fire and blood." This warning came in February, 1763, and the next month saw Silán committed to the cause of the English. He told the Ilocans not to believe the Spanish story that Manila and Cavite had been recovered, adding that the conquerors were advancing inland and were already obeyed by the Tagalos and Pampangos. They were kinder to the Indians than the Spaniards had ever been, freeing them from oppressive tributes. Two cargoes of provisions were sent to Manila with letters and presents from Silán, who assured the English governor that he would henceforth dedicate himself to the service of King George. The alliance was accepted, and arms and other presents were sent to Silán, who proclaimed himself alcalde for his Britannic majesty. Captain Brereton, the senior naval officer and governor of Cavite, addressed him by this title on May 6, 1763, promising help and arms and actually delivering a little bronze cannon. The Ilocans were urged to trade with the forces holding Manila.

But the rebellion was drawing toward an event which ruined its organized activity. Before May was over Silán was assassinated in his own house by a *mestizo*, whom the captive bishop had blessed as he set out to make the attempt. The clergy were liberated from imminent danger by the death of Silán, and celebrated a *Te Deum* thereafter. The insurgent army fell to pieces upon the loss of its leader and the era of vengeance soon began. There was an intermediate stage of petty civil wars, the Spaniards having incited the men of Amianan to attack Vigan, and the rebellion rallying under new chiefs again and again. The Spanish columns were slow, since their general was wont to retire to a safe distance from the scene of action, in accordance with a military regulation, "which he observed with exactness, as though he were fond of it," says the friar who kept the chronicle. The purpose of the regulation was "to preserve the understanding and other powers free and clear for taking the necessary measures without disturbance from fear" (Vivar).

When the fighting men were scattered the gallows had its day in Vigan. Only three were actually put to death by hanging, the widow of Silán and two of his officers. For lack of skillful hangmen the commanding officer had to build a pen in which the rebels could be conveniently slaughtered, before their bodies were displayed on the gallows. This device enabled him to get rid of ninety. Others were held in prison; many were released—after a sharp flogging. During the rebellion certain heathenish ceremonies had been revived. Since two hundred years of Christianity had not obliterated these customs, the chronicler felt constrained to suggest a remedy: "If the Ilocans saw a couple of old women hung up in their towns now and then, I am sure that they would leave off their rites." There would seem to have been no lack of such object lessons during the two years which followed the death of Silán.

After Vigan had been punished the rest of the province was overrun, and the rebels were driven to the forest, whence they were hunted during campaigns lasting until March, 1765. The bands employed in pacifying Ilocos reported that they had killed about 10,000 insurgents, with a loss of seventy Spaniards and twice as many "loyal" natives. The returns showed a total diminution in the population of the province to the figure of 26,000—the difference between that and the estimate of slain being due to starvation, emigration and other causes. The decrease of population in Cavite province in 1897 was apparently somewhat greater than the estimate cited for Ilocos. Bands of Ilocans were levied in 1764 to complete the conquest of Pangasinan. They fought without pay or rations, but they brought back the horses and *carabaos* of their rebellious brethren when the campaign was over. Yet the chronicler complains that the rebels were made equal with the faithful: "Towns which tore out their entrails to shake off the Spanish domination were treated as well as those which did likewise to maintain the Spaniards in power." Of course, the British made no effective protest against the slaughter of Silán and their other allies. They lacked force to invade the northern provinces of Luzon, and neither diplomacy nor humanity had much to say during this interregnum.

The English had employed Chinese on their expeditions,

arming them and allowing them to pillage, according to Spanish accounts. The Chinese of Guagua in Pampanga province, to the number of 900, fortified themselves and defied the Spanish power in November, 1762. Anda promptly attacked their trenches and killed some hundreds of them. He then ordered the slaughter of all the Chinese in the island. Much zeal was shown in the execution of this mandate for a while, and some thousands perished before the loyal party wearied of the sport. The massacre was not to be compared with those of the seventeenth century, however, since tens of thousands were cut off after the insurrections of 1603 and 1639.

In July, 1763, six months after the treaty of peace had been signed, a report of the suspension of hostilities reached Manila. In any other part of the world an armistice would have been arranged, but there was too much political confusion and corruption in the Philippines to allow this. The British government had made no provision for restoring the conquest, and there were no despatches from Spain. Anda refused to notice communications sent through the archbishop, and he rejected documents addressed to him as commander-in-chief of the Spanish forces, claiming the title of governor-general as a preliminary to any negotiation. He would not allow British officers to bring proposals to his quarters, saying that they would make reconnaissances. Drake declared that Anda would be responsible for bloodshed that might occur in future. Anda replied that the responsibility rested with those who neglected the forms due him and thus impeded an arrangement. He also circulated rumors that the articles of peace were forged and did all that he could to protract the petty strife and the miseries of the colony. On the other hand, an English officer reported that every appearance of reconciliation was opposed by Governor Drake and his creature because "war was their harvest."

So there was no peace in the Philippines in 1763. Anda moved his camp to Polo, only three leagues from Manila, and stirred up the natives to harass outposts and cut off foraging parties—the only expeditions sent out by the garrison. Finally, the poor archbishop died, and the British addressed Anda as Governor after January 30, 1764, thus securing a suspension of hostilities. Anda demanded the immediate evacuation of Ma-

nila, and the withdrawal of the British to a camp of his selection. Naturally this proposal was declined, and Manila and Cavite were held as firmly as ever, even the churches of Cavite being invaded and stripped of their ornaments. In March a conference between British and Spanish commissioners was inaugurated at Tambobong (Malabon), but before anything was settled the meeting was dissolved. The order for evacuating the Philippines had come at last, and the English began to collect supplies for the voyage, demanding assistance from the Spaniards to expedite their departure. They were told that scarcity to the verge of famine had resulted from the war, and many impediments were thrown in their way. Fort San Antonio was surrendered to the Spanish on May 26, and the forces of Anda entered the city on May 31, with salutes and a *Te Deum* in the cathedral.

The Spanish frigate which brought letters from Madrid arrived on March 15, after a voyage of 83 days from Acapulco, bringing also a new governor commissioned by the king. Governor Torre had the discretion to be ill on May 31, and the ragged regiments of natives, the Spanish detachments, and the companies of deserters from the British—mostly Frenchmen, no doubt—were led into the walled city by the obstinate and invincible Anda, who proceeded to levy the sum of $335,000 from the citizens of Manila to balance the indebtedness contracted for the support of his troops in the field. Anda had manifested some purpose of holding fast to the government when the invaders had been expelled. He had heard that Villacorta, the judge whom the English had sentenced to death, had remarked that he thought the post belonged to him rather than to Anda, whereupon he was placed under arrest. Other judges and prelates were consulted; while most were noncommittal, the provincials of the Jesuits and Franciscans upheld Anda as the only man who could save the situation. The royal order settled the point in 1764, but Anda was regularly installed in power in 1770.

The Augustinian order had suffered more severely from the English occupation than any other corporation: "They plundered and laid waste fifteen of our convents and six estates. Ten of ours died during the war, nineteen were carried off as prisoners, and twelve were banished. They seized our chief

convent at Manila and sold it out, not sparing the flooring or the tiles of the roof, nor the dispensary, library, and lodgings." Thus wrote a survivor of this season of trial. Padre Zúñiga, writing after another generation had passed, finds Anda as cruel to his order as Drake had been. He removed them from their parishes in the country, installing Filipino priests in their place, and their rural convents were almost in ruins before the friars were allowed to return to their charge. Anda retired from a capital full of his enemies and died in obscurity. Later generations have been taught to exalt his memory, but the foreign student can hardly regard him as a skillful warrior or a rational administrator. None of those who celebrate his patriotism have ventured to credit him with modesty or humanity. The notion that he reconquered the islands will not bear examination. When the conference was held at Tambobong in March, 1764, the Spaniards asserted their readiness for recapturing Manila. The British answered by asking why Pasig was left on their hands, though weakly fortified and garrisoned. If such an outpost could not be carried there was little danger in the citadel of *Intramuros*. If Anda failed as a strategist and disciplinarian, he won few laurels as a pacificator.

But the British leaders would gain little by inviting a comparison. Sir William Draper had no trouble in disposing of an improvised defense conducted by irresolute amateurs, but he abandoned his conquest before its administration was organized, and his lifelong pose as a neglected hero was hardly justified by the achievements of forty-eight days in the Philippines. Admiral Cornish staid by his fleet some months longer, but he had no part in the extension of English authority outside the range of his guns. All the responsibility of civil government was left to an agent of the East India Company, to a man trained in the lawless and rapacious methods of the worst period of that company's history.

Governor Drake did nothing to put an end to hostilities even when he knew that peace had been arranged in Europe. He used the forms of justice as interpreted by courts of his own creation to extort money and plate from an impoverished population. To descend to a concrete instance, when leaving the palace whence he had ruled his province he stripped the rooms of "sconces, lustres, lace hangings, and velvet curtains," all of

which were boxed, marked "Rice for Governor Drake," and taken on board the ship which conveyed him to India. Thus reads the statement of Captain Backhouse, who was in command of the garrison until the governor charged him with mutiny, and had him arrested by a squad of soldiers with fixed bayonets, led by a subaltern who appears to have taken a bribe from the governor. Drake quarrelled with officers of both services up to the moment of evacuation, and then made an undignified exit with a shipload of plunder.

The material condition of the capital when it was restored to the Spaniards was doubtless on a par with its moral status. The British removed some of their Chinese coolies and other camp-followers of both sexes, thus diminishing the danger of famine. Certain persons charged with treason to Spain because they had served the English were also allowed to embark. All the Spanish reports are full of charges against Fallet, a Swiss resident of Manila, and Orendain, a *mestizo* doctor of laws. Both had led the natives in unsuccessful sorties during the siege. Otherwise, there is no genuine evidence of disloyalty, unless Spanish suspicion be regarded as evidence. Industrial organization and commercial activity could not be improvised when hostilities terminated. Both sides had confiscated too much property and levied too many ransoms since 1762. The walled city had suffered bombardment, some 5000 shells and 20,000 solid shot having been fired by the English, though the damage was not proportionate to the weight of metal. The suburbs and all towns within the radius of action of the invader had suffered from fire and pillage. The native subjects of Spanish rule had been stirred up by the passions of civil war, and they were left without the shadow of legal protection when the aliens withdrew.

Before attempting any critical interpretation of this episode, another enterprise may be briefly noticed. The Sultan of Sulu (Jolo) had some relations with the English during their occupation of Manila where he was forced to reside, and he was persuaded to grant them the island of Balabac (Balam-bangan) for military and naval uses. The Spanish authorities were inclined to protest on the ground of their vague claim to the sovereignty of the Suluan Archipelago—Borneo was also claimed by a similar title. The chiefs and corsairs of Sulu were divided

into three parties, one favorable to Spain, one ready for alliance with the English, and the third—and doubtless the largest—disposed to sell themselves to the winning power. Finding Balabac "sterile, with a bad climate and worse water," the English had tried to exchange that island for a station near Sulu—in spite of the excellent position of Balabac and the advice of strategic cartographers. A considerable garrison and some colonists were sent from India, and the island doubtless had a larger population in 1775 than it has ever had since.

Since Spain was not ready to expel the English by force, a campaign of intrigue was begun. The English offered a better trade, and were indifferent in matters of religion. On the other hand, the Sultan and his son had lived among the Spaniards and found them more affable and flexible than the English. The decisive influence, however, was based upon practical and piratical considerations. An English naval station would check the favorite pursuit of the *Moros* far more effectually than the Spanish flotillas had ever done, and this peril had to be averted. Besides, it was known that large quantities of Indian goods were stored at Balabac.

A Suluan *dato* named Teteng, after leaving home on account of gambling debts, had settled at Balabac with his slaves and retainers under a contract to cut timber. Finding himself unable to quit the island without leaving his slaves as hostages, Teteng denounced the British governor, who had him thrust into the stocks—a serious matter for a *Moro* chief. Abandoning his slaves, the malcontent went to Jolo to recruit a mixed company to seek revenge and pillage. With runaway slaves and unemployed pirates to the number of 300 an expedition was organized at an island not far from the English settlement. The English had fortified the harbor by two batteries connected by a covered way, but had no guns commanding the landward approaches. The original garrison of 400, made up of Sepoys and English soldiers, had been reduced by climatic diseases until only seventy-five infantry and twenty-eight artillery were available.

Teteng and his pirates hid in the jungle and attacked the batteries in rear at daylight on the morning of March 5, 1775. The garrison had grown negligent, had been celebrating some sort of a holiday; "strong liquors (*el ron y la ginebra*) always

bear a part in what happens to this people," notes a sober Spaniard. With their barracks in flames the garrison was cut off without resistance, the *Moros* losing only two men, and the governor fled to a brigantine in the port. He had to make sail without rescuing any who had lingered ashore. A second brigantine was fired upon and captured by the pirates before she could escape.

The news caused much excitement and some alarm in Sulu. Teteng was outlawed by a decree of the council, but the arrival of the victor on March 23 reversed the action of the court. The sight of the plunder overwhelmed all scruples; cloth of all varieties, silks and cotton, chests of opium, iron and steel from Europe, diamonds, ingots of gold, and $14,000 in silver coin were exhibited. Moreover, there were 45 cannon, 228 muskets, other small arms, and a vast store of ammunition, and all this went to the sultan. A man who could acquire such riches and share the spoil with generosity was bound to be well received anywhere, "especially among Suluans," says our chronicler. Even the slaves got something, and the whole nation was bound together in enmity of the English.

English journals for 1776 heard of the loss of Balam-bangan —which was sometimes confounded with Bombay—but such an island hardly counted in that fatal year. The goods carried off by the *Moros* had cost $946,000, and the projected pearl-fisheries had to be abandoned. And Lord Pigot, appointed to govern the new colony, sailed too late to find it garrisoned. The Spanish congratulated the sultan over his gains, and there was some dealing in prize goods at their town of Zamboanga. But the arrogance of victory led to activity in the national pursuit, and the Suluans continued their depredations on the coasts of Luzon for another century. The Spaniards finally established a naval station on Balabac, and there was some talk of trade coming that way. The expectation was not realized, though the station was maintained up to 1898.

A brief account of more primitive plans for securing British influence in the Philippines may be of interest. In 1588 Cavendish, after taking the Manila galleon near Cape San Lucas—the wrong galleon, since he had to burn most of her rich cargo of China silks, though he saved satins and brocades for a suit of

sails to carry him into an English port—anchored at the island of Capul in the Strait of San Bernardino, where he hung his Portuguese pilot and made friends with the natives. Hakluyt's Voyages record that, "On the 23d day of January, our General, M. Thomas Cavendish, caused all the principals of this island and of an hundred islands more, which he had made to pay tribute unto him (which tribute was in hogs, hens, potatoes, and cocos) to appear before him, and made himself and his company known unto them, that they were Englishmen, and enemies to the Spaniards: and thereupon spread his ensign and sounded up the drums, which they much marvelled at: to conclude they promised both themselves and all the islands thereabout to aid him whensoever he should come again to overcome the Spaniards. Also our General gave them, in token that we were enemies to the Spaniards, money back again for all the tribute which they had paid: which they took marvellous friendly, and rowed about our ship to show us pleasure marvellous swiftly: at the last our General caused a saker to be shot off, whereat they wondered, and with great contentment took their leaves of us." This genial performance was quite as effective as the Spanish trick of annexing islands by proclamation.

Dampier, the scholarly buccaneer of the next century, lingered on the coast of Mindanao for some months in 1686, and would have induced his shipmates to accept proposals made by the *Moros* had he held any authority among them: "Indeed upon mature thoughts, I should think we could not have done better than to have complied with the desire they seemed to have of our settling here, and to have taken up our quarters with them. For as thereby we might better have consulted our own profit and satisfaction than by the other loose roving way of life, so it might probably have proved of public benefit to our nation, and been a means of introducing an *English* settlement and trade, not only here, but through several of the Spice Islands, which lie in its neighborhood." "We had also a great advantage above raw men that are sent out of England into these places, who proceed usually too cautiously, coldly, and formally to compass any considerable design, which experience teaches better than any rules whatsoever; besides the danger of their lives in so great and sudden a change of air; whereas we

were all inured to hot climates, hardened by many fatigues, and, in general, daring men, and such as would not be easily baffled. To add one thing more, our men were almost tired and began to desire a *quietus est;* and therefore they would gladly have seated themselves anywhere. We had a good ship too, and enough of us (besides what might have been spared to manage our new settlement) to bring the news with the effects to the owners in England." They had come to Mindanao hoping "to get a commission from the Prince of the island to plunder the Spanish ships about Manila, and so to make Mindanao the common rendezvous." The conquerors of 1762 had much the same aspirations.

In attempting to criticise such enterprises as the English attacks on the Philippines it is useless to distinguish too sharply between their moral aspect and their practical result. If they brought ruin and waste along with them, they must be classed among the failures, if not among the scandals, of history. But it cannot be asserted that the purpose of these undertakings was high, or that they were executed in rational and humane fashion. Sir William Draper formulated his principles of conquest by claiming that places carried by storm were subject to whatever the conqueror chose to inflict: "Manila was in this horrid situation, the lives of the inhabitants, with all belonging to them, were entirely at our mercy." Considering the situation in this light, Draper was, like Clive, "astonished at his own moderation." He admits slackness in the discipline of his troops, "a motley composition of seamen, soldiers, sepoys, cafres, lascars, topases, and French and German deserters." But the ransom of $4,000,000 was nothing to what might have been gained by systematic pillage, and casual irregularities on the part of the invader could not be alleged to justify repudiation.

Whether Draper's instructions contemplated annexation or not, it appears that the cooperation of disaffected natives was counted upon. To organize the revolutionary impulse thus to be inaugurated there was the paltry and motley garrison in the hands of the predatory Mr. Drake and his fellow-servants of the East India Company. The story of Spanish weakness and its origin in misgovernment was not unknown to those who planned the expedition. What institutions, laws, and administra-

tive reforms were inaugurated by Great Britain? Except for vague professions of benevolent intentions in regard to taxes and forced labor, there was no manifestation calculated to win the natives to accept a new order and an intrusive civilization. Nor does there appear to have been any sense of responsibility for the sequels of alliance with insurgent natives or mercenary Chinese.

Of the defects of the Spanish system of domination, defects which led to the collapse of every moral and military element of defense at the first shock of foreign invasion, this is no place to speak. The narrative written by the Marqués de Ayerbe in 1897 notes these errors and warns his countrymen against the results of persistence in a mistaken policy. He reminds them that "The English employed the native element in that very province of Cavite, which we have just had to reconquer foot by foot." He notes the unpopularity and inadequacy of theocratic government in seasons of peril, and the lack of force to maintain Spanish authority in remote colonies. Yet he still had faith in reforms, and by no means counselled abandonment.

The strategic lessons of our subject are sufficiently obvious. No nation can maintain a sound colonial system beyond the radius of her maritime supremacy; yet the Spanish claim to dominate the shores of the Pacific was never supported by the concrete reality of sea-power. Next to superiority in naval strength comes the maintenance of communication between the mother country and her possessions, or between the belligerent government and its agents abroad. Both Spain and England failed in organizing the transmission of intelligence, and their commanders in the Philippines were left to sin or suffer in ignorance. The miserable incidents which result from the despatch of an army of invasion made up of heterogeneous and undisciplined elements are no less apparent than those attending the effort to wage defensive warfare among a disaffected population. Of the tactical lessons of the campaign even less can be said. The rules of eighteenth century warfare were not observed on account of the demoralization of the defense. Nor was there much opportunity for the development of tactical skill in the punitive and foraging expeditions sent out from Manila. The mortality among the invaders does not seem to have been large, but we have no figures that will bear discus-

sion. The British garrison was too small to show a great numerical loss—the Spanish claim that it amounted to 1000—but guerrilla warfare and defective sanitation doubtless claimed their percentage. But history is concerned with the results of conquest rather than with the incidental expenditures.

Authorities Consulted.

ENGLISH.

Annual Register, 1763 and 1764.—These volumes were edited by Edmund Burke, and they contain a sketch of contemporary history based on current discussion and documents. Burke has been censured by Crawfurd (*Dictionary of the East Indian Islands*) for presenting too favorable views of the conduct of Sir William Draper in his account of the Manila expedition. It is to be regretted that the situation during the period of British occupation was not discussed more fully.

Dictionary of National Biography.—The first step in studying any period of English history is to read the life of someone connected therewith in this masterly work—the only systematic and complete work of reference in the English language available for the general reader. Unfortunately, the notice of Sir William Draper falls below the usual standard of the series and is not to be compared with the naval biographies prepared by Professor Laughton, which now reveal the true naval history of Great Britain after generations of darkness. No references are given to the *London Gazette* or the *Annual Register*. A false reference is given to the *Reports of the Historical MSS. Commission*, which do not print the original instructions given to Draper. I have been unable to consult Beatson's *Naval and Military Memoirs*, but references to the *Calendar of State Papers, Home Office*, 1760-5, and to *Horace Walpole's Letters* have been found interesting.

History of England in the Eighteenth Century, W. H. E. Lecky. —The political and diplomatic affairs of the period are clearly set forth and fairly discussed in these volumes.

Frederick the Great, Thomas Carlyle.—The graphic notes and summaries of general history often furnish the best illustrations of the period.

SPANISH.

Historia de las Islas Filipinas, Padre Fray Joaquín Martinez de Zúñiga, Sampaloc (Manila), 1803.—The English translation of this work by Mavers has been used, though it appears to be an imperfect rendering of the original. This seems the best general history of the first two centuries of Spanish domination.

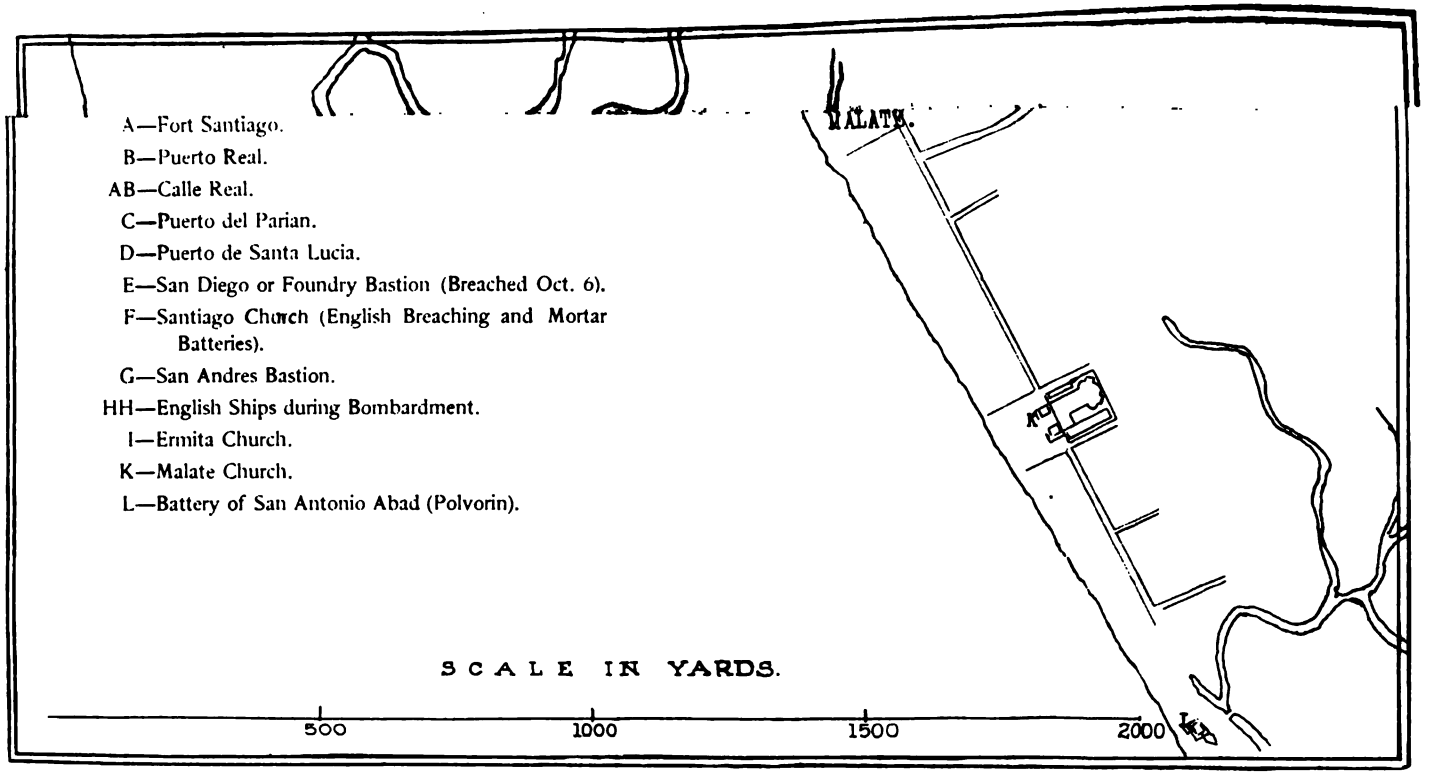
Sitio y Conquista de Manila por los Ingleses en 1762, Marqués de Ayerbe, Zaragoza, 1897.—The introduction is rather artless in its handling of authorities, Goldsmith's *History of England* being cited, for example. Zúñiga's history and one written by the Dominican Fathers have been consulted, but the chief value of this pamphlet of 135 pages is derived from an unpublished MS. by Don Rodríguez de Ovalle. This officer was sent out with despatches and made the voyage from Acapulco to Manila in 83 days, arriving March 15, 1764. He then set to work to collect authentic details covering the events of the last two years. He seems to have been a fair critic of military affairs and not an adept in the art of wholesale vindication. His narrative should have been printed at length.

Relacion de los Alzamientos de la Ciudad de Vigan, Padre Pedro del Vivar, Religioso Agustina, 1764 (*Biblioteca Historica Filipina*, vol. iv, Manila, 1893).—This gives an account of the insurrection led by Silán in 1762-3.

Guerras Piráticas de Filipinas, Don Vicente Barrantes, Madrid, 1878.—This book is principally based upon an anonymous document, which chronicles various phases of the struggle with the *Moro* pirates up to the beginning of the nineteenth century. It describes the expulsion of the English from Balabac.

Memoria acerca de las Misiones de los PP. Agustinos Calzados en las Islas Filipinas, Madrid, 1892.—This notes the losses of the Augustinian order during the British occupation.

Historia de España, Don Modesto Lafuente.—An excellent general history of Spain.


A—Fort Santiago.
B—Puerto Real.
AB—Calle Real.
C—Puerto del Parian.
D—Puerto de Santa Lucia.
E—San Diego or Foundry Bastion (Breached Oct. 6).
F—Santiago Church (English Breaching and Mortar Batteries).
G—San Andres Bastion.
HH—English Ships during Bombardment.
I—Ermita Church.
K—Malate Church.
L—Battery of San Antonio Abad (Polvorin).
MALATE.
SCALE IN YARDS.
500
1000
1500
2000

DISCUSSION.

"OUR NEW BATTLESHIPS AND ARMORED CRUISERS." See No. 96.

Rear Admiral R. D. EVANS, U. S. N.—The questions propounded by Naval Constructor Taylor are the most serious and important ever put to the sea-going officers of our service, and we owe him not only our thanks for asking them, but our earnest professional opinion in answering them.

For me, the answer is an easy one. I say unhesitatingly that we are making a serious blunder in building ships so much alike as the battleship Virginia and the armored cruiser Maryland, and the sooner we stop the practice and get back to sound military principles the better it will be for us when battle shall give us the only real test.

In the days of wooden ships our superiority was entirely owing to the heavier batteries we carried, and when we became the builders of steel battleships our first efforts were splendidly successful because we stuck to the same principle. I say battleships, but it was equally true of all classes. In our cruisers we added also the quality of speed, because we recognized the fact that speed to a certain extent was the controlling factor in the vessel intended for scouting work and not intended for the line of battle.

Gradually a change came, and somebody with sufficient influence to dominate the Navy Department began to undo the good work of our constructors, until to-day we find thin armor and light guns the rule in our projected ships of the line of battle.

I am surprised that Mr. Taylor does not see the cause of all this, or does not, if he sees it, come out squarely and condemn it and suggest the remedy. To my mind the craze after speed in a battleship is at the bottom of it all. The desire for a thing that is absolutely of no value after you get it has compelled the thinning of the armor and the reduction in caliber of guns, two of the vital things in battleship construction. In order to obtain 19, or, worse still, 21 knots' speed, we must sacrifice the things that make a battleship, and having attained this speed on the trial trip, we can never hope to reach it again because we can never realize the same conditions in actual service. In other words, we must carry around during the entire life of the ship a lot of dead weight in the shape of machinery which should have been put on the outside in armor, and in the battery in armor-piercing guns. Cut the speed of our battleships down to sixteen knots sea speed, and then on a displacement of 15,000 tons give us all the protection you can, and a steaming radius as great as possible.

Battleships are not intended to do the work of cruisers; they are intended to fight, and for that purpose alone they are built. If others choose to thin their armor in order to get speed let them do it, and when the day of battle comes they can run away or get whipped just as they prefer; they amount to the same thing when you consider the ob-

jects of a naval campaign. Make the distinction between the battleship and the cruiser clear and distinct. Heavy armor, heavy guns, and moderate speed, with great manœuvering qualities, the features of one; great speed and coal endurance the features of the other, with as much armor and battery as possible; but above all things stick to the moderate speed for the battleship, because it is the attempt to get away from it that makes of her an indifferent armored cruiser.

The craze for rapid fire in armor-piercing guns has had its share also in the retrograde movement in our later battleships. I do not for a moment doubt or discount the value of rapid fire up to a certain point, but beyond that point it has absolutely no value and will only deafen men and overheat the guns. A well-sustained, accurate fire of moderate rapidity will win over the unevenly sustained and inaccurate fire that must follow the effort to fire with the greatest possible rapidity.

It would have been only reasonable to expect that, as armor was made more perfect and more difficult to penetrate, we would find more armor-piercing guns in our new ships, but such is not the case. On the contrary, we find the 12-inch instead of the 13-inch, and the number of 8-inch reduced, as in the case of the Alabama and Illinois, in favor of the rapid-fire 6-inch, a purely cruiser gun, in my opinion, and one that certainly cannot pierce the armor now being generally put on foreign battleships outside torpedo range.

In conclusion, let us come back to the sound principles as shown in our first battleship—a few more guns and a little more armor than others have. Let our constructors bend their minds and energies to giving us a ship of about 15,000 tons with armor protection for the entire ship; speed sixteen knots sustained at sea, and the following battery as near as may be:

Four 13-inch guns, *in turrets*, forward and aft.

Twelve 8-inch guns in broadside, with sufficient splinter protection but *no turrets*. Four of these guns to be capable of firing directly ahead and four astern, and all so arranged that they may be worked entirely by hand in case of necessity.

Twenty-five to thirty 50-caliber 14-pounders, and such smaller guns for torpedo defense as can be properly installed.

We can have such a ship, I am sure, if we are willing to take her with a speed of sixteen knots.

Lieutenant-Commander J. B. MURDOCK, U. S. N.—The very pertinent questions with which Mr. Taylor closes his article open up the whole question of armored ships. The status of the battleship is becoming fixed. Naval opinion the world over seems to be settling towards the adoption of the twelve-inch gun as the maximum caliber. These are supported by a broadside battery of six-inch, generally in a casemate. After building several ships of this type, we have reverted to the eight-inch gun in turrets in addition to the two other calibers. I think this change as outlined in the new battleships is most satisfactory to the service. The eight-inch has always been a favorite in our navy, and

since the Spanish war is more of one than ever. The battery design of the Virginia is formidable, and the ship, from our point of view, is fully able to carry her guns. The type to me seems most satisfactory, not excelled, in fact, by any afloat.

The armored cruiser is more the result of compromise between conflicting conditions than any other class of ship, and as a result there are numberless very different types in existence in different navies. Standard there is none, but it is all essential that the vessels designed for any navy should be adapted to its necessities. In our methods of construction we are more in touch with the British than with any other nation, and many of our ships, the Maryland perhaps among others, have been designed as improvements on British types. This is wise or not, just as the needs of our service may agree with or differ from those of the British navy, and it is as well that we should study the whole world of naval construction. Thus the Italian built Colon has been greatly admired in our service as an admirable type of armored cruiser, combining apparently all necessary qualities on very small displacement.

In 1898 Great Britain laid down ten armored cruisers of a size and speed greatly superior to any existing. There were six of the Cressy Class of about 12,000 tons and four of the Drake class of 14,000. The two types were designed for 21 and 23 knots respectively, and their evolution is largely due to the construction of fast French armored cruisers built as commerce-destroyers. British trade has already been a favorite object of French naval attack, and if war should ever arise between the two powers, the ancient practice of commerce-destroying would be again brought forward under the fancy that it was war.

If France builds men-of-war for any such purpose, the possibilities arising therefrom must of course be considered by the Admiralty. Hence the cruisers of 1898.

It does not seem to me to be sound policy for us to follow any other nation in our construction. While it may be a source of gratification to our designers to improve on a type which is recognized by everyone as very good, or to the nation at large to know that it possesses the biggest or fastest man-of-war afloat, it is unquestionable that these laudable ambitions may load our navy list with freaks and frauds—ships absolutely lacking in naval efficiency. Let us rather study our necessities and act accordingly. First and foremost are the demands liable to be made on the navy by the country. Apart from the vital importance of keeping an enemy away from our coast, we are entering as a world power on complications undreamed of ten years ago, and the possibility of hostilities in any or all parts of the world shows that the work of the navy will be arduous if war should arise with any first-class power. The loss of the command of the sea may involve the loss of any of our outlying possessions, and communication can be kept up only by having a powerful naval force at any and every threatened point. The best of officers can do nothing without ships, and he must have not only enough, but they must be of the right kind as well.

If we glance over the world, examining the numerous places at which we may come in contact with other naval powers, and then analyze each case, we will find everywhere the demands are practically the same. We will need, when war comes, good honest fighting ships—ships that not only show the flag, but can uphold it in a general fleet action. Auxiliaries, scouts, cruisers, torpedo-boat destroyers and torpedo-boats will all have their places, but no one, nor all together, can decide a naval campaign. That must be done by the fighting ship par excellence. As we have no commerce to protect and have outgrown the aberration which induced us to build the Columbia and Minneapolis, we have no call to build any vessel for patrolling our trade routes or attacking an enemy's.

To my mind, this is so clear that any armored vessel built for our navy appears as useless if she is not a fighting vessel. Instead of armored cruiser, I prefer to use the term "battle cruiser," to represent a vessel having the speed of a cruiser, but yet so designed as to be able to take a place in the line of battle in a fleet action and give a good account of herself. She must have speed, and by providing small vessels of this class—fast second-class battleships if you will—an unwilling enemy could be chased, harassed and very probably detained until he could be brought to action. A "battle cruiser" of this type would have a greatly increased radius of action over the heavy battleship, and could do a thousand things much better. The work of the New York in the Spanish war is a justification to us for the "battle cruiser" beyond any argument.

If this reasoning is correct, our "battle cruiser" must possess the following main qualifications: First, speed, at present set at 22 knots; second, sufficient gun power to be able to give heavy blows against battleships in action, and third, enough armored protection to give the ship a chance for life even when opposed to much more powerful foes. Small guns and thin armor must be shunned, as unfitting the ship for actual battle. As in the old days, 90- and 74-gun ships fought in the same battle-line, so to-day there is nothing inconceivable in having battleships and "battle cruisers" similarly associated, provided *the latter are built for the purpose*. I see no reason why we should not adopt the rule that every ship on which armor is placed should be designed to fight in company with battleships, and am sure that in this way we can secure the best return to the nation for its money. Can we afford to spend millions on a ship that cannot fight?

With these general ideas in my mind, I am not enamored with the Maryland type. They are powerful vessels and possess great offensive and defensive strength, but not to my mind as much as they should, or as much as could be given them. A solid citadel of five-inch Krupp steel covering all gun positions is admirable, and is much stronger than that possessed by most battleships now in service for their broadside battery. The Maryland, however, is not only liable to meet ships now in commission but others building, as well as many not yet laid down, and her design should have every possible improvement to forestall, as

far as may be, future advances in construction and ordnance. Now, as a fact, we find that the Italians and Japanese are designing their latest vessels with six-inch plates. A still worse feature of contemporary foreign design is the fact that other nations are using heavier guns behind their thicker armor. The Maryland's six-inch guns are powerful weapons, but are weak against the six-inch armor we find on foreign ships, while their eight- or nine-inch guns would penetrate hers with comparative ease. A ship must not be not only inherently good, but must rank high among her contemporaries.

In order to fairly test the Maryland, let us compare her directly with ships either existing or laid down. Many of the former have Harvey steel instead of Krupp, and, in the comparisons made, will be credited with Krupp in order to bring them up to the same date as the Maryland. The data given in the report of the Chief of Bureau of Ordnance for 1899 will be used as a basis. He gives the following perforations of Krupp armor in inches by our latest type of guns:

	At 1000 yards.	At 2000 yards.	At 3000 yards.
8-inch, Mark V	10.44	9.34	8.25
6- " " VI	7.28	6.14	5.3

One of the best of recent ships is the Asama of the Japanese navy. Giving her the Krupp armor that is actually going on later ships of her class, we find that she has the same speed and armament as the Maryland, while her gun positions are protected by six-inch armor instead of five. Four six-inch guns are without armor, and her battery power is thus brought below that of the Maryland. At 3000 yards, however, she has fourteen protected guns that could penetrate the latter's armor, while her own armor is liable to injury only from the four eight-inch guns of the Maryland. It is difficult to avoid the conclusion that the Asama is the better fighting ship, yet she is of 4000 tons less displacement and probably cost a million dollars less.

In comparison with the latest German cruiser, the Prinz Heinrich, there is some uncertainty as to whether the six-inch guns of the latter have four- or six-inch armor. Assuming the latter to be the case, we find the same state of affairs existing as with the Asama. At 3000 yards the German has twelve guns that can pierce his adversary's armor as against four of the latter that can injure him. As the Maryland has the advantage of a knot and a half speed, she could close to a range where her battery would become effective, but as her great length makes her unhandy in manœuvering as compared with her adversary, the latter might succeed in torpedoing her. In this case the issue between the two ships is by no means certain, but the Maryland is 4500 tons the largest and cost at least a million dollars more.

Coming to ships still on paper, we find the Amalfi class in Italy. The scheme of development of this class is to obtain 22 knots, with six-inch armor protection and eight-inch guns on moderate displacement. There is some doubt as to the exact form the type will finally develop, but let us assume that given in the Naval Intelligence Annual for 1900,

as it is not impossible. Here we find our adversary as having the same speed as the Maryland and with a battery of twelve eight-inch guns, capable of piercing all her armor at any practical fighting range, while our ship can use only four guns with any effect beyond 2000 yards. To accomplish anything it will be necessary to close, but our smaller and equally fast antagonist can easily out-manœuver us and choose his own position. As before, we find the Maryland struggling unsuccessfully with a smaller antagonist.

The British Drake and Cressy classes have light armor over their six-inch guns, but carry two 9.2 guns apiece. The former is probably more powerful than the Maryland as having a knot more speed. It is noticeable that both of them have been criticised in Great Britain as lacking fighting power.

It may be gratifying to know that our new type of cruisers could probably defeat the New York and Brooklyn at once, but they are not of her date. What we should seek is the greatest *fighting efficiency* (this includes speed and handiness, as well as battery and armor) on a given displacement. Has this problem been solved in the Maryland? Let us take her sister ship, the Colorado, and modify her as follows: Shorten the citadel about one-fourth so as to allow it to have six inches of armor throughout. Remove two of the six-inch guns on the gun deck. Replace the four six-inch guns on the main deck by eight-inch and give them six inches of armor protection; change nothing else. We have slightly increased the weight but imperceptibly, and the two ships would have the same speed. We have now:

	Maryland.	Colorado.
Speed, displacement, stores, armor belt, etc.....	The same in both.	
Battery	4 8-inch.	8 8-inch.
	14 6-inch.	8 6-inch.
Armor over 8-inch guns.....	6½	6½
Armor over 6-inch guns.....	5	6

The Colorado, by keeping outside 2000 yards, would have comparative immunity from the Maryland's six-inch guns, while all of her own would be effective against the latter's citadel up to 3000. I think this Colorado by far the better ship of the two, and strong enough to meet foreign ships.

To come down to Mr. Taylor's questions. I would not build any more Marylands at all. Powerful as they are, they are too cumbersome for manœuvering, and not strong enough either offensively or defensively for the line of battle. They would, moreover, be a nuisance in a squadron from their clumsiness. Recognizing their unquestionably good points as I do, they do not seem to conform to the requirements of our service for practical fighting ships.

I believe that our latest type battleships are fast enough and big enough to answer all demands. There is, as already stated, an ever-existent demand to build something bigger, and, hence, more powerful

than anything in existence, and although the British Admiralty is conservative in its policy of construction, we read of its laying down 18,000-ton battleships. Let us resist the temptation to improve on this type. We are getting a long distance away from the idea of handiness, and yet good manœuvering power is one of the essentials in a fleet action, as important perhaps as speed. In the long naval wars of the Napoleonic era, Great Britain left big ships to her adversaries, and did most of her fighting with her 74's. This class won at the Nile, St. Vincent and Trafalgar, and British officers of the day laughed at the unwieldiness of the Santissima Trinidad, Orient and other leviathans. Is there not a lesson here for us to bear in mind?

Although outside the discussion proposed by Mr. Taylor, it is noticeable that every criticism I have suggested against the Maryland class applies with still more force to the St. Louis. The latter has four-inch armor and no gun larger than a six-inch. It is no argument, however true it may be, to say that the new six-inch is as powerful as the old eight-inch. We should not arm our new ships to compete with old types, but ought to make them fit adversaries for any of their date and displacement in the world. The St. Louis would have a poor chance in a combat with the Asama or Amalfi of the same size, as they could riddle her at a range of 3000 yards, while their own armor would defy her six-inch guns. It would be almost like fighting a wooden ship against an armor-clad. I believe that the St. Louis could be easily modified on her present displacement to carry eight eight-inch and four six-inch all behind six-inch armor. Would she not be a vastly more efficient ship for our navy? Under this construction she could take her place in the line of battle and penetrate the casemates of any existing battleship at ranges up to 5000 yards, or the turrets of half of them at 2000. To be sure she might suffer herself, but it would take the main battery, twelve- or thirteen-inch guns, of any but the most recent battleships, to do her serious injury.

My answer to Mr. Taylor's questions is, therefore, a compromise. I would build nothing larger or faster than the Virginia, but would develop a smaller and handy battle cruiser of about 9500 tons. If the money for eight Virginias were put at my disposition, I believe the demands of our national policy would be better met at present by five Virginias and five St. Louis, modified as above. This would give us ten fighting ships, every one available for battle, and five as well adapted for ordinary service as the New York and Brooklyn have shown themselves to be.

Mr. Taylor would call this a revision to an old type, but it is, I believe, the true policy for us to follow.

Captain CASPAR F. GOODRICH, U. S. N.—In my judgment, no more important article than this has ever been published in the PROCEEDINGS OF THE NAVAL INSTITUTE. I have but one regret in connection with it —that it was not written and printed several years ago. That it will prove epoch-making I have no hesitation in predicting.

My answers to the questions with which Mr. Taylor concludes his interesting and instructive exhibit of facts are as follows:

To the first, emphatically, "No; we are *not* warranted in continuing to build at the same [or any] time vessels of so nearly the same size and cost, and differing so widely in other respects, as the Maryland and Virginia."

To the second, emphatically, "No; it is neither consistent nor logical to increase again the speed of our battleships to, say, 21 knots."

To the alternate form of his question I answer emphatically that it would not be well to build either four Virginias and five Marylands, or eight Virginias or seven Virginias of 21 knots' trial speed. "Of two evils, choose—*neither*"—so spoke a wise old lady of Puritan stock.

Let us endeavor to put the case on a war footing. Admiral Blank commands our fleet, with which he has to meet the powerful squadrons of our adversary, the Emperor of the Antipodes. He is given by the conventional fairy the fulfilment of a wish. He may call for such ships, in type and number, as he thinks best suited to his wants, provided, however, they do not cost more in the aggregate than the amounts allotted for shipbuilding in the annual appropriations of the past few years. What form will his wish take. How will he ask that these vast sums had been spent? Having this superhuman power, will he create such a fleet as we have been preparing for him? If we can guess these riddles, we shall be in a position to reply intelligently to Mr. Taylor's queries.

In the Maine class, the displacement of our battleships took on a notable increase, and this growth has steadily continued in later designs, while the armored cruisers have jumped from the Brooklyn's 9200 tons to the astonishing figure of 14,000 tons in the Maryland. Admiral Blank, knowing these things, does a little mental arithmetic, which shows him that by keeping to the dimensions of the Iowa, for example, he would have saved on the five classes of armored vessels represented by the Maine, Georgia, Virginia, California and Maryland, no less than 35,740 tons, enough to add three Illinois to his command. He would, moreover, have a homogeneous fleet composed of units practically identical in dimensions, in battery power and battery distribution (even with the widest latitude for variations in details) and, most important of all, absolutely identical in tactical qualities. By the plan we have followed, Admiral Blank has lost three good ships, carrying 54 or more guns in their main batteries. And what has he gained in their stead? A knot or two more speed in the later vessels and some hermaphrodite affairs, called armored cruisers, for which he can find no place in his line of battle, and this at a time when he needs all the fighting craft available and more too. If Admiral Blank is a good American, he has surely studied Captain Mahan's essays, and he has read that numbers are needed to crush—numbers of ships, numbers of guns, numbers of men. He will find nowhere in the writings of that eminent authority any suggestion that especially high speed is essential in a battleship. What is decided by speed is a race—not a fight. If

fleet A is stronger than fleet B, the latter gets behind forts and barricades the harbor entrance. If it is caught outside by fleet A, I grant, cheerfully, that it will rejoice in the advantage of an extra knot or two on its part, but as I understand the matter, battleships were constructed for a very different purpose—to meet, not to run away from, the enemy. When they seek refuge in flight they confess defeat.

I grant, also, the value of high speed in strategical movements, but of what earthly use is it to make the tremendous sacrifices which we have, unquestionably, made in numbers of ships and in equality of tactical features in order to gain a couple of knots for certain individual members of the fleet, when, as is axiomatic, the squadron's rate is that of the slowest, not the fastest ship?

No one doubts for a second the intrinsic merits of the more recent additions to our list of battleships. If they were destined to roam the seas each on its own account, then would it be well, perhaps, to secure greater speed, greater powers of offence, greater protection, greater coal endurance, without regard to harmony of action, but the case with which Admiral Blank has to deal is a very different affair indeed. It is the last expression of our most serious needs; our existence as a nation may lie trembling in the balance. After but little deliberation, he says: "The speed of the Oregon at Santiago is speed enough for me. I wish the money appropriated for armored ships to have been expended on battleships, all reasonably similar in design and having the speed and tactical qualities of the Iowa, that I may have three additional ships with which to meet the enemy, even if none of them can steam over seventeen knots."

If the Emperor of the Antipodes means business, Admiral Blank can not have too many guns with which to receive him. If he does not mean business, then superior speed will not avail to force an action. I have always been of the opinion that we can pay too dearly for that extra knot or so. Trial trip reports, with their glowing accounts of a fraction of a knot achieved over previous records, may appeal to the public ear, but they can not possibly have great weight with the tactician who reads, between the lines, that a new type or pattern of ship has been added to our already bewildering multiplicity. No one, I hold, has any right to entertain or express an opinion on types of fighting ships who has not carefully studied the chapter in Colomb's Naval Warfare, which treats of the gradual development of the 74-gun ship as the rational outcome of a century's warfare and a century's search for what, taking all things into consideration, was the best unit in the line of battle.

May a strong believer in the torpedo be permitted to suggest that the times are ripe for omitting that weapon from the armament of a battleship? Keep the item, 4 torpedo-tubes, on the navy list, but calmly leave the things themselves on shore and don't burden the line-of-battleship with their heavy and useless fittings.

Mr. Taylor pertinently asks, why build more armored cruisers? Rather, I say, why have built any at all? The first two, the New York and the Brooklyn, were laid down, I fancy, simply because similar ships ap-

peared in certain European navies; so, of course, we must have them too. The logic is very clear, it will be perceived, and it has proved convincing, but a defender of the type on purely tactical grounds has never, so far as I know, stepped into the arena to champion their cause. I wish he had. In 1895, in a lecture at the Naval War College, I used these words:

"Of the armored cruiser, I confess, with deep regret, my inability to treat. I can find no logical place for her in the fleet. She is less than a battleship and more than a cruiser. She is a compromise, with all the disadvantages which compromises present. Her speed is immense, true, but that follows from her displacement and horse-power, not from her military features which are largely sacrificed to speed."

No tactical study of the type has come to my notice, and nothing has happened since the time those words were written to remove my grave doubts as to the merits of the armored cruiser.

If anything at all was demonstrated beyond peradventure at Santiago, it was the helpless, hopeless inferiority of the armored cruiser to the battleship, yet six more of the type, all as big as battleships and costing practically as much money, have been designed and contracted for since the treaty of peace with Spain. I can not understand such obstinate clinging to a class discredited in actual warfare, and I regret, beyond measure, the diversion of so much money from the paramount aim of a navy—strength in its line of battle.

Mr. Taylor has done the navy a lasting and a notable service in suggesting that we pull up and do a little thinking before plunging in too deeply. Personally, I am confident that the fear he hints at rather than expresses will be realized, and that we shall all be sorry for having run to an extreme. No one will appreciate this error more than Admiral Blank, for, unhappily, the good fairy of fiction will not appear at the critical moment to rescue him from his embarrassment by turning his job lot of ships, each of which is freely admitted to be admirable in itself, into what alone he needs so urgently—a homogeneous fleet. While Admiral Blank will do the best he can with the tools at hand, he will roundly anathematize those who, having the means and the opportunity, failed to provide him with properly equalized units, and if he thrashes his opponent, as we fondly hope he will, it will be in spite of, rather than on account of, our erratic building programme.

Commander RICHARD WAINWRIGHT, U. S. N.—Naval Constructor Taylor's paper is most valuable from the clear manner in which he has presented the facts. It will prove far more valuable if it aids in settling the types of vessels to be built, according to some tactical rules.

Since the new chief constructor has come into office the fallacy of sheathing battleships has been killed, and we may hope for the burial of "fire-proof" wood. A still greater victory for sound knowledge, both of theory and practice, will be the designing of ships for certain tactical uses within reasonably definite limits.

For many years we have been designing new vessels, each one being

more or less superior to its predecessor of the same type, and this superiority has been largely made possible by increased displacement. Better guns, better armor, better engines and better forms have not been sufficient, but greater displacement has been required. I believe we have reached the limit of size, if we have not passed it. Our future improvements should not be in the line of increased displacement.

I do not believe we would be warranted in continuing to build more Marylands, and I do not believe we would be warranted in building larger Virginias. It is not very difficult to show the strategical and tactical advantages of high speed. To me the need for armored cruisers is as apparent, although the reasons for holding this belief are not so easily pointed out. Nothing is so clear as the strategic advantages of speed. The tactical advantage of being able to force your enemy to fight is also apparent. But there is an additional tactical advantage in superior speed, in fleet actions or in single combat, of being able to concentrate a greater number of guns on a given point than your enemy. In a single ship with greater speed you can present beam fire to your opponent's end fire, and in a fleet you can present beam fire of a number of ships to the end fire of a few of your opponent's ships. Certainly you can make too great a sacrifice for speed. There will be little use in bringing the guns of a greater number of ships to bear on the enemy if it still leaves you with fewer guns and less well defended.

All will admit that it is necessary to have some type of vessel that will bear the same relation to the modern battleship that the frigate did to the old line of battleship. The divergence of opinion arises when an attempt is made to outline the type. I believe that the armored cruiser should take the place of the frigate. Many give this place to the protected cruiser, not the most recent protected cruisers which are armored, but to those protected by armored decks alone. Some will go further than this and use the auxiliary vessel for that purpose, where none of the displacement is sacrificed for protection and very little for armament. These latter are admirably adapted for a portion of the work allotted to a frigate, as they have a very large steaming radius. The objection to both auxiliaries and to protected cruisers is their want of sufficient protection to enable them to run necessary risks with reasonable chance of success. Armored cruisers should have sufficient protection to encounter the fire of one or more battleships at long range, and their own class at short range, with some chance of getting away with the information gained. To be able to close in with an enemy's vessels so as to gain accurate information and to tow a damaged battleship out of action, they should have slightly superior speed to battleships of the same date and a larger steaming radius. An improved Colon, with battery as in the San Martin, particularly if the oil jet for high speed is a success, about fits my idea of an armored cruiser.

While certain individual vessels may prove wonderfully successful in unusual circumstances, the sound general rule for war vessels would be never to build vessels of a type such as must run away from smaller vessels; Marylands to run away from Oregons, or Columbias to run

away from a Texas. The feet of the army are most important to the general, but battles will never be won by showing the enemy your heels. To carry out this rule, protected vessels, if built, should not be above six thousand tons displacement, armored cruisers not above eight thousand; after that, all should be battleships. The more nearly these latter can be made of the same tactical qualities the stronger they will be when grouped together.

Captain Walker, in the September number of the PROCEEDINGS, says, speaking of the modern armored cruiser: "Her rôle in a nation's fleet is assumed to be that of a vessel possessing in a high degree offensive and defensive qualities, with the capacity of delivering her attack at points far distant from her base in the least space of time." The latest armored cruisers do not possess in a high degree offensive or defensive qualities, and the only justification for the sacrifices made to speed would be to insure that the enemy was weak where the attack was to be delivered.

A study of naval tactics justifies the existence of torpedo-boats, destroyers, light-draft gunboats, small armored cruisers, and battleships. Uses can be found for other types, but they can only be justified by exceptional circumstances and not by the ordinary course of events in time of war.

Prof. P. R. ALGER, U. S. N.—Mr. Taylor's paper is a challenge to show cause for a belief in the supremacy of speed among the factors whose combination measures the offensive and defensive power of warships. Is the possession of two, or even three, knots greater speed an advantage sufficient to balance an overwhelming superiority of gun power and of armor protection? Certainly in the crucial test of battle, superiority of speed would count for almost nothing in comparison with superiority of armament. The Maryland, with full bunkers and full ammunition supply, will have a displacement of 14,875 tons, and is a much larger ship than any we have thus far built. What would the country and the world at large think of her commanding officer if he should decline combat with any single hostile ship he might meet? Public opinion will demand, and rightly, too, an ability to fight commensurate with size and cost. And yet what chance would the Maryland have if he met a hostile Virginia, and of what possible advantage would her greater speed be to her excepting as enabling her to escape certain defeat and destruction by flight. It is true that more Marylands than Virginias can be built for a given sum—Mr. Taylor says 5 of the former as against 4 of the latter type—but supposing a squadron of 5 Marylands to engage a squadron of 4 Virginias, can anyone doubt the result? Only under exceptionally fortuitous circumstances could any projectile fired by the Maryland pierce a vital part of the Virginia, while every hit of one of the latter's 12-inch guns would do serious damage. In fact, a vessel like the Virginia, if her armor were distributed with a special view to contend with vessels like the Maryland, might remain for a long period under the fire of a whole squadron of

Marylands without suffering any serious diminution of offensive or defensive powers. As the ships stand, in my opinion, five or even six Marylands would have no chance whatever in action with four Virginias. Are there, then, in other fields than that of actual combat, any advantages of superior speed sufficient to counterbalance this great inferiority in fighting power? I can only say for myself that I am unable to find them.

Lieutenant S. E. W. KITTELLE, U. S. N.—In answer to the questions asked in Naval Constructor Taylor's article, I am of the belief, for a given expenditure of money, and we shall probably always be thus limited by Congress, that it would be the wisest policy to build seven enlarged Virginias of 21 knots trial speed, or eight of the present Virginia type, rather than a combination of four Virginias and five Marylands.

Our building policy, if we had one, should be based upon the strength of possible antagonists, with a view to providing a preponderance of strength in our favor. Conditions seem to preclude hostilities with Great Britain at any time. Setting aside sentiment and considering only facts and monied interests, it will be seen that of England's annual consumption of breadstuffs, she produces only 22 per cent and imports 78 per cent, of which 50 per cent comes from the United States, the remaining 28 per cent from Russia and Argentina. This takes no account of the large shipments of beef imported from the United States. Vast sums of English capital are invested here and much American money is being used to develop English underground railroads and other enterprises. These conditions, coupled with a common language and a similarity of interests in many ways, should be enough to make both nations avoid hostilities.

A navy is needed to protect commerce and defend the sea coast and foreign possessions, consequently the greater these interests are the greater the navy needed to defend them. As a measure of commerce, the value of exports may be fairly taken, as it is the export trade that is sought after. The export statistics are as follows:

Great Britain	$2,648,711,578
United States	1,255,494,358
France	926,979,000
Germany	906,335,178
Russia	362,674,000

From the above alone it may be argued that we should have the second largest navy, but taking into consideration the exposed sea coast and large distant colonies of France, and the vast empire of Russia, with so few seaports that without a powerful navy she would be liable to a close blockade, it is believed that France and Russia will, during the next five years, continue to hold the second and third places respectively. The present sea interests of the United States make it necessary that we should hold not lower than fourth place in the maritime strength of nations, which place is at present held by Germany.

In order to attain fourth place it will be necessary to consider what strength Germany will have and to arrange our building program so as to give us a somewhat greater strength. The law governing the building program of Germany provides by 1916 38 battleships and 20 armored cruisers, but the wording of the law permits this large fleet to be constructed by 1908, and it is a constructive possibility to complete it in 1906, if an emergency should require.

Our navy, therefore, by 1908 should, in the line of battle, be stronger than that of Germany. We now have 17 battleships and 11 armored cruisers, built and building. We should, by 1908, have at least 38 battleships and 20 armored cruisers. As Congress failed to authorize any ships this year, we have only seven years in which to build 21 battleships and 9 armored cruisers, or at the rate of 3 battleships and 1 2/7 armored cruisers per year. Under ordinary conditions, Congress will generally be willing to authorize four armored ships a year, and as our armored cruisers are at present more powerful than those of Germany, we can afford to ignore the question of armored cruisers for a period of five years and build instead four battleships annually. In this way we would, in 1906, have 37 battleships built and building, a force of sufficient strength to enable us to pause to reconsider our building program, and in the next two years, if conditions then require, build one battleship and three armored cruisers yearly, giving us by 1908, 39 battleships and 17 armored cruisers, built and building. This leaves the United States one battleship in excess and three armored cruisers in arrears of Germany, but in each type our ships are of superior size and offensive power, insuring us fourth place in the list of naval powers.

Lieutenant JOHN M. ELLICOTT, U. S. N.—My views upon the subject of this paper will appear at length in the pages of the PROCEEDINGS in an article on "Warship Design from a Tactical Standpoint." They were more briefly stated in an essay on "The Composition of the Fleet," published in the PROCEEDINGS in 1896 (Vol. XXII., No. 3, p. 541, last paragraph).

For tactical purposes we need two or three different elements in a fighting force on the sea just as we do on land. Unfortunately (from a professional standpoint) we have had no great fleet actions between modern warships which fully demonstrate in what characteristics the elements should differ, yet such fleet engagements as recent history records illustrate unmistakably, to my mind, the special value of armored cruisers. If the Japanese had had such vessels in the battle of the Yalu, one can scarcely believe that they would have allowed the crippled Chinese warships to get into Port Arthur. Again, granting equal morale and efficiency to the personnel on both sides at Santiago, the Colon would certainly have outstripped the Oregon, and no other vessels but the New York and Brooklyn could have prevented her from escaping. A Virginia, in a fleet engagement, might with probability have her battery and guns' crews placed *hors de combat*, and still be able to retire

from action with unimpaired speed. While in such a condition, however, a Maryland from the reserve could pursue her and force her to surrender.

I am a firm believer in the comparative method of studying land and sea compaigns, for the principles upon which each must be based are identical. The only extensive land campaign with up-to-date weapons and conditions is that which the British are now terminating in South Africa. Most instructive comments on that campaign are now to be found in the pages of foreign military periodicals. Such men as Captain Trimmel of the Austrian General Staff, Count Sternberg of the Austrian Army and Major Callwell of the British Army, all of them present in South Africa, point out with emphasis that no real progress was made against the Boers until the British organized and employed *mounted infantry*. Prior to that they sometimes won a battle at great sacrifice, but the elusive enemy, after a brief recuperation, was as ready as ever for combat. As I have tried to show, I believe that just such an analogous condition will be found to exist in future naval campaigns, and that we will find in our armored cruisers a much-needed mounted infantry of the sea.

In modern war, mounted infantry cannot be dispensed with unless soldiers had the swiftness and endurance of horses; armored cruisers cannot be dispensed with unless battleships can have the highest warship radius and speed.

Lieutenant A. A. ACKERMAN, U. S. N.—Although authoritative views have been specifically invited to this discussion, no presumption is intended in offering the remarks here set down; they must stand or fall according to their own merits.

In past discussions, when the present development of neither battleship nor armored cruiser was foretold, and when, least of all, did they appear as rival claimants for naval appropriations, the writer favored the building of both. It was the habit then to compare the armored with the unarmored cruiser, and in that light the reason for the former's being was clear and strong. It had much of the protection of the battleship and had lost not overmuch of the mobility and economic advantages of the cruiser. They were to be marauders, a type of commerce-destroyer, capable of blocking trade routes despite the convoying cruisers; able to make sudden descents on unprotected ports without suffering great hurt to themselves.

Our ideas as to the duty of the navy in time of war have greatly changed since that time. A war to be carried to a speedy and successful ending must be fought out. If our naval strength is to be frittered away in chasing the enemy's commerce from the seas, the war may last indefinitely. Such a program, too, presupposes a mean opponent; he is expected to humble his pride and sue for peace in order to continue trading, when it very probably may have been contentions over that trade which caused the war. Judging from the past, when it has been *our* trade which suffered through this method of warfare, the result

tends chiefly to exasperate without impairing the naval strength in any marked degree. In fact, it turns peaceful merchantmen into fighting bluejackets.

If the enemy is to be brought to a condition in which he may with honor sue for peace, or relinquish the claims made against us, it is either because his fighting strength is impaired or because he finds that he cannot impair ours; not because he finds that he is losing money through the more or less desultory capture of his merchantmen. This is especially true of those powers to whom the mere state of war means an immense loss of trade with us.

A nation aroused and in arms will not be sordid; even though leaders may doubt the wisdom of continuing a war, the people, as a people, once committed to a course they believe to be just will continue in it, and the only way to peace lies through loss of fighting strength whether the dollars have influence afterwards or not.

The opinion has grown to a certainty that the first duty of the navy in time of war is to fight. And in carrying out that duty, whether to await the enemy at our own threshold or to seek him out wherever he may be found, depends upon circumstances. However that may be, the idea that our battleships are to be relegated to the defense of harbors cannot be tolerated. They are not as good for the purpose as the much less costly and practically invulnerable forts; their special qualities, only obtained at vast expense, are thrown away; besides that, there never will be a sufficient number of them to distribute among even a few of our greatest ports to be able to meet such forces as an enemy could concentrate against them. The conclusion is irresistible that the navy in war must operate on a grand plan; ships and fleets must work in unison. For such work those ships are the best which are most able to carry out their part of the general plan; that are able to go where they are sent and to stay where they are put in spite of the efforts of the enemy.

We now insist that our battleships shall cruise, and they do so, almost at the same speed and in most cases as economically, or even more so, than the equally large but weaker types to which the armored cruisers have grown. The demand is for a cruising battleship, not an armored cruiser, and for this reason the latter has sought constantly to ape the former, and with such success that the only characteristics of the cruiser left her are the latter's weakness in battery and a comparative unprotection. It is true that she still retains an excess of speed of three knots over the battleship; that will be lost, however, as soon as it is decided to slightly lengthen the latter. On the other hand, the cruiser has gained as complicated an organization, a more numerous crew and as great a cost for maintenance as the heavier ship.

Taking the matter less generally, the question of cost may be discussed first. Our people as a rule do not object to a particular type of ship primarily on account of its cost so long as they feel that they are getting their money's worth. That is, that the ship will do what it is intended to do, is the best of its class and that the portion of the appropriation going into profits is not unreasonably large. It is not believed that

Congress would hesitate at the difference in first cost between a battleship and an armored cruiser if convinced that the country needed the former more than the latter. There are uses for all types from tugs to battleships, but the work of the last is superlatively important and direct, while that of all others is subordinate and indirect or desultory and indecisive.

It must be evident to all that, however liberal within probable grounds the plan of increase of the navy may come to be, the country's needs for such a defense are increasing at a far more rapid rate. The type of ship most certain to be found too few in our next war is the battleship. It is the one type which cannot be extemporized; the one type for which there is no substitute.

The question has been put whether to build four battleships or five armored cruisers with the same money. If our country needs sturdy fighters, able to give and take punishment, then the relative values of the two types as fighters should govern our decision. All other considerations are of minor importance and serve only to obscure the qualities which will be depended upon to bring the war to a successful close.

Naval Constructor Taylor has already explained that the steaming radii of the two types will be practically the same, but even if there was a greater difference in favor of the cruiser, the demand for more coal could not be greatly postponed, and so long as we lack coaling stations, it must be met in either case by slow-moving colliers. In fact, the real differences between the two types are that one has three knots more speed than the other, which has greater powers of offense and defense.

The armored cruiser is avowedly made inferior as a fighting ship to the battleships of the same date. In other words, every naval power with whom we might go to war possesses a number of ships which it would be folly for our armored cruisers to face. That means that they cannot go where they are sent, nor dare they stay where they are put if the enemy objects. The cruiser's speed may save her, although Naval Constructor Taylor points out how readily a battleship her equal in that respect could be designed; moreover, in war time not much dependence will be placed on those ships whose chief recommendation lies in their ability to run away from the enemy's line of battle.

The fact is, however, in war our armored cruisers, though unfit, will be expected to fight as battleships. Let us consider a duel between vessels of the two types. Both have a numerous battery of light guns, which, as they are of no avail against the casemates at battle range, will be left out of consideration; the same reason of range excludes the torpedoes which balance each other in any case. The battleship of the Virginia class has a one-inch thicker casemate than the Maryland, covering approximately one-third greater area. It would be most extravagant to regard the extra 6-inch gun in the broadside of the Maryland as neutralizing this great difference in protection. Let us suppose it, however, and also that the belt of the battleship, which is impenetrable to the cruiser's guns, is offset by the heavier protective deck on the latter. The two ships have then opposed in broadside, 4 8-inch and 7 6-inch

guns equally protected. If this reasoning is as liberal as it seems to be, the battleship could fight a cruiser on each beam on equal terms and yet hold her 4 12-inch guns in reserve for the *coup de grace.*

There is another view to be taken of the armored cruiser in action, should they elect not to attack battleships even when two to one. Their armor is penetrable under favorable conditions by guns of calibers carried not only by their own class but by many protected cruisers. Let the result of a fight with one of these vessels be, however, victorious, the disabling of one of the casemate guns means the loss of a considerable portion of her offensive powers. This is not the case with the battleship, which could continue on duty almost as formidable as ever, even though great havoc had been made in her casemates. The armored cruiser, after a fight even with inferior ships which had resisted with spirit, would doubtless have lost considerable of her fighting strength and be greatly in need of repairs.

It is evident that for some time the two types have been approaching each other and may ultimately coincide. Let us hope that this will soon occur, and when it does that it is brought about rather by increasing the protection and caliber of the cruiser's guns than by further reducing those of the battleship.

It seems almost axiomatic that if, no matter what the rest of the world is doing, it can be expected that our ships will be able to go where they are sent and stay where they are put, the art of waging war will become much more simple.

Lieutenant JOHN HOOD, U. S. N.—Nothing could be more timely or more directly to the point than the question raised by Mr. Taylor in his article on our new battleships and armored cruisers in the PROCEEDINGS OF THE NAVAL INSTITUTE for January, 1901.

Stated fairly, the question is, that the time has come for the adoption of a fixed naval policy in the construction of our fleet, and the selection of the best type or types of vessels that the fleet constructed with the many available shall be, on the whole, the most perfect fighting machine in existence, providing in the largest measure for a given expenditure, the best known means of offense and defense, in naval warfare, and how all this shall be done.

The question is so broad, including, as it does, not only the naval policy of the country, but strategy and tactics as well, that it is difficult to discuss it intelligently in a limited space, and only a few of the most important points suggested by Mr. Taylor's question will be touched on here as they occur to the mind of the writer.

Notwithstanding ingenious theories in regard to other weapons, changes of design in ships and armaments due to the advance of science, and new inventions of various kinds, the final arbiter of naval battles is and remains the gun and the man, just as it was in the days of Nelson and Collingwood, and the ship that can put into action the greatest number and weight of guns, fired with the greatest rapidity and accuracy, will prove the victor in naval conflicts to the end of time. The

most perfect type of gun-carrier yet designed by human ingenuity, and the one that can keep the sea and be ready to meet any enemy at all times and under all conditions is the modern battleship, and since to meet and destroy the enemy's ships is the first and primary duty of the fleet, it is an indisputable fact that the battleship is, and will always remain, the basis of any properly organized navy worthy of the name.

In any future naval conflicts, it is to our fleet of battleships that we must look for final victory and success; for all other components of the fleet are auxiliary only, however necessary and important they may be, and should be designed to the sole end of increasing the efficiency of and supplementing the usefulness of the battle fleet, rather than on any false ideas of a possibility of their replacing it.

Any true system of naval operations, either offensive or defensive, contemplates meeting and destroying the enemy at sea, or at least so crippling him that his operations will be frustrated, and *not* in waiting supinely to meet him on our own coasts, trusting to ingenious devices and strange weapons of very limited ranges of action to destroy him after he has gained the mastery of the sea. To accomplish this requires sea-going and sea-keeping ships of the highest powers of offense and the greatest fighting endurance, that are capable of meeting any enemy in battle, and this type is represented by the battleship only.

The battleship has, however, its limitations in that its size must not be unreasonably large, or we sacrifice its manœuvering and tactical qualities, which are absolutely essential to concerted fleet actions, not to mention the enormous increase in cost. This limitation in size imposes a corresponding sacrifice in speed to retain the full measure of fighting efficiency necessary, and to supply this loss the battleship must be supplemented by auxiliaries of greater speed and less cost, whose duty it is to discover and keep in touch with the enemy, destroy his auxiliaries when opportunities occur, and provide the battle fleet with the information necessary to meet and engage the enemy.

Some remarks on the subject of battleship speed will be made further on, but it may be stated here that, in the opinion of the writer, the limit to both size and speed for battleships for efficiency, has been reached in the designs for the Virginia and her class, and it is a question if their value would not have been increased by dropping a knot, or perhaps a knot and a half in speed, and putting the corresponding weight saved in coal and armament.

If the ideas suggested above of a battleship organization, with accompanying auxiliaries, be accepted, the adoption of a fixed policy of naval development should be easy of attainment, though there will probably be considerable differences of opinion as to the exact character and number of the battleships needed, as well as of the necessary auxiliary complements. It will, however, hardly be disputed by any one who has given any study to naval tactics and warfare that one of the first and chief requisites for efficiency in the fleet is homogeneity of the units of each of the components, and one of next importance is that the number of the components should be limited to the smallest number

required by naval warfare that money and effort may not be wasted and every member of the fleet be fitted to fulfill its designs. In other words, only such classes of vessels should be built as are required by the most approved thought on naval war, and the vessels of each class should be of the same general types and sizes. Otherwise the manœuvering and tactical qualities of the fleet are sacrificed, the power of concentration and concerted action impaired, and much money wasted in the production of freaks and vessels of little value.

All this is extending the question somewhat further than Mr. Taylor states it in his very admirable article; but it would be as well to include the whole fleet in the discussion, as it appears to the writer there has heretofore been as little plan and system in the development of the lesser branches of the fleet as in that of the greater, and the adoption of a plan of naval construction should embrace all types necessary to and desirable for an efficient navy.

In determining what types of vessels are necessary to an efficient navy, it is well to keep always in view the purposes for which a navy is created:

1. First and foremost, to rush, fight, destroy or capture the enemy's fleet, and gain the mastery of the sea.

2. To defend our own coasts and outlying possessions.

3. To destroy and interrupt the enemy's commerce and communications and protect our own.

4. To police the ocean, afford help and protection to our citizens and commerce in disturbed countries, and maintain the honor and dignity of the flag and nation.

The nature of these duties clearly defines the types of vessels needed within very narrow limits.

For the first, as has been already indicated, are needed sea-going battleships of large coal capacity and of the greatest fighting powers attainable, with the necessary attendant cruisers of great speed and even greater coal endurance. Attached to this first fighting line, though there would arise cases when they must be left behind, should be the sea-going destroyers, whose size might profitably be increased to about 800 tons displacement, that they might be rendered truly sea-going and sea-keeping.

For coast defense proper, beyond that supplied by the battle fleet, are required torpedo-boats and submarine boats of the best design, that promise in the near future to prove the most efficient coast protectors yet designed. The construction of monitors and like craft for coast defense or other purposes seems to be a waste of good money that might far more profitably be applied to the battle fleet.

For the destruction of the enemy's commerce and protection of our own are required cruisers of the same type as those attendant on the battle fleet.

For the police of the ocean and protection of our citizens and flag in foreign countries, in places the battle fleet cannot reach, are required gunboats. Of these not more than two types are needed, cruising gun-

boats of about 1500 tons displacement, and smaller gunboats of about 500 tons displacement for river and inland water work.

Considering these suggestions, it seems to the writer that the following types of vessels, and no others, should be included in a well-conceived plan of progressive naval construction, and on them, in the proportion that will be discussed later, should be expended all the money available for naval construction purposes:

1. First-class battleships of the general type of the Virginia.
2. Armored cruisers of two classes—(*a*) a limited number of the general type of the Maryland, and (*b*) the cruiser fleet proper of the general type of the Brooklyn.
3. Torpedo destroyers or cruisers of about 800 tons displacement.
4. Torpedo-boats of a uniform type of about 150 tons displacement.
5. Submarine boats of the latest designs.
6. Gunboats of two classes—(*a*) cruising gunboats of a general uniform type of about 1500 tons displacement, and (*b*) river and inland water gunboats of about 500 tons displacement.

We have, of course, at the present time a large number of intermediate cruisers of types almost as variable as their number, and these should be used to the best advantage as long as they last. But in planning for the future, it would hardly seem that any of them are worthy of repetition, for their minor duties can be equally well and far more economically performed by the cruising gunboat class, and their higher duties would be infinitely better performed by a lesser number of the larger cruisers of the class (*b*) type suggested above, and the battle line much strengthened at the same time. Similarly, we have on hand or building a variegated conglomeration of torpedo crafts, many of them of undoubtedly excellent design that will prove very valuable additions to the coast defense of the country. They would prove far more valuable still, from the increased efficiency of their crews when formed, had all of them been of standard pattern. The rule for their construction in the future should be unity of design with the best type selected as a model.

As before stated, the battleship is the foundation on which all future naval projects must rest. Its characteristics should be fighting power enough to overcome and speed enough to join combat with any enemy's vessel of its class. Its *first* requisite, however, is the power of fighting and resistance, and, its *second*, speed; and the first should never be sacrificed for the second. In the vessels of the Virginia class, it would seem that this question of battleship speed had reached the limit of its usefulness, and any further increase would cause either a great and unnecessary increase of cost, accompanied by unwieldiness of size and loss of manœuvering and tactical powers, or an unwarrantable loss of fighting power. For, as so clearly shown in Mr. Taylor's contrast of the battleship and armored cruiser, it is all a question of weights or cost or both. For a vessel of given size, all that goes into extra speed is just so much deducted from armor, armaments, coal or other essentials, and it would scarcely be called wise to sacrifice the main object

for which the ship was designed to attain an extra knot or two of speed that a couple of months of marine growth on the bottom will destroy, and that the vessel will rarely, if ever, be called on to make. Battles will never be fought at nineteen knots, and such speed is only needed by battleships to bring an unwilling enemy to action. Nineteen knots, or even a little less, is sufficient for that purpose in the case of any enemy's battleships we are likely to encounter, and the task of overhauling his fastest cruisers must be left to our vessels of the same class. The limitations of nature, and of human nature as well, are contrary to the combination of the battleship and cruiser in one, and any attempt to do so will prove a failure, both from its great cost, and from the lack of manœuvering and tactical qualities in the enormous vessel the combination would produce.

In regard to the two classes of cruisers advocated in the above list, both are necessary under existing conditions, though both cost and tactical considerations would point to one only. For the ordinary purposes for which cruisers are used, class (*b*) alone would be sufficient and desirable. But since all the leading navies of the world have, or are building, vessels of the type of class (*a*), necessity compels us to be provided with a limited number of the same type to be able to meet them on equal terms, or else run the risk of having our other scouts and cruisers fall an easy prey to a superior enemy. The number of these vessels should, however, in the opinion of the writer, be limited to the necessities imposed on us by our possible adversaries, and our chief care should be the increase of the line of battle and fleet of scouting cruisers of class (*b*).

Turning to the subject of torpedo-boats and destroyers or torpedo-cruisers, it is quite thoroughly recognized now by all authorities that the field of usefulness of the torpedo-boat proper lies in coast and harbor defense when the boat acts from a base.

But the larger field of the destroyer and torpedo-cruiser is still an unsettled question. It is the opinion of the writer that by increasing the size of the destroyer somewhat, it can be made sea-going and sea-keeping for a long enough time to be a most valuable adjunct to the sea-going battle fleet. There would undoubtedly be some expeditions on which even the enlarged destroyer would be a hindrance rather than a source of strength to the battle fleet, but in much of the work, and on many occasions, they would be most efficient scouts, and could take advantage of favorable nights for torpedo attacks on the high seas, while their great speed would always enable them to avoid a superior enemy by day. The size of 800 tons suggested above may not meet with the approval of the best authorities, but the subject is a matter well worthy of consideration in formulating a plan for naval development.

Summing up the foregoing remarks in an answer to the question, somewhat broadened, propounded by Mr. Taylor, the writer would say that he is of the opinion that a definite naval policy should be adopted, and with it a settled plan of naval construction founded in a fleet of so many battleships, the number being the key to both policy and plan.

He would, himself, suggest at least 30 battleships in active service at the end of a period of 10 years, this to be increased by 10 more at the end of another period of 5 years, by which time some of the older ones would be in reserve.

For every two battleships built he would recommend one (1) armored cruiser equal or superior to the most powerful cruiser built in any navy at the time.

For every battleship built, he would build one armored cruiser of the class (*b*) noted above, one enlarged destroyer or torpedo-cruiser and two torpedo-boats.

For every three battleships built he would build one (1) submarine boat of the latest design.

The number of gunboats of the two classes needed would be regulated by the exigencies and conditions of the times. For the present, the number of gunboats and small unarmored cruisers we already have, or are building, will serve the purpose, and they need not be considered, and all the money available devoted to the construction of the other branches of the fleet on the lines laid down above.

In the construction of this fleet, the most excellent design of each of the types of vessels recommended should be selected as a model, and the design be adhered to, only varying it in detail in the case of some important new discovery, so that each class will be practically uniform and homogeneous.

Having made the plans, designs and estimates for the scheme of construction recommended, and found that less money would be available in the time than the plans called for, the proportion of the various classes should be preserved and the construction extended over a longer period of years, though delay may prove fatal in the present condition of the navies of the world and the political aspect of affairs in the East, for our next enemy will not be Spain, nor will a converted yacht, a tug, and a gunboat prove an efficient line of battle in the next war.

Lieutenant E. W. EBERLE, U. S. N.—I have read with much interest the valuable paper on "Our New Battleships and Armored Cruisers," by Naval Constructor D. W. Taylor, U. S. N., and it merits very careful thought and study. If the line officers of the navy will study this subject and give their candid opinions in future numbers of the PROCEEDINGS OF THE NAVAL INSTITUTE they will not only fulfill the object of Mr. Taylor's excellent paper, but at the same time they will render the navy a great service, because the opinions of the tactical officers are of the highest value in the development of a sound building policy.

I fail to see either wisdom or plausible theory in a policy that requires the building of armored cruisers of 12,000 or 14,000 tons displacement. Even the ardent admirers of large unwieldy Marylands cannot claim offensive, defensive, or tactical merit of very high order for those vessels. At two thousand yards' range the Maryland's guns give her no offensive merit, her armor gives her no defensive merit, and although she is credited with very high speed, her manœuvering

qualities in the line of battle at the above range is seriously compromised by her great length and enormous displacement. Compare a Maryland with the Argentina's San Martin (and improved Colon), a vessel of about 7000 tons displacement, and judge from their offensive, defensive and manœuvering qualities, you would quickly choose the smaller vessel as the winner in a "stand-up" fight. I will admit that a Maryland could decline a challenge to fight by taking advantage of her phenomenal speed, but it would be very demoralizing to the spirit of the crew, and would rudely shock the high moral enthusiasm of the country, to have the large 14,000-ton Marylands run away from vessels one-half their size.

Why do the friends of the Maryland class cling so persistently to their favorite argument that the speed of these vessels will enable them to decline a fight and escape? History proves that battles never have been won by *running away*, and I feel safe in asserting that battles never will be won by such tactics. Let the enthusiastic defendants of these large unwieldly armored cruisers, whose main defense and greatest merit lie in their *escaping qualities*, take to heart that wise quotation: "For he who fights and runs away, may live to fight another day." During hostilities, the time will come when these vessels will be forced to fight, and they should be given the offensive and defensive qualities that will enable them to make a hard fight for vessels of the armored cruiser class.

Why not take an improved Colon as our armored cruiser type, and limit the displacement to 9000 tons. This displacement should enable us to build a vessel carrying armor of moderate thickness and a heavy battery, and at the same time possessing high speed and good manœuvering qualities. Such vessels would make efficient scouts for the battle-fleet and would occupy important places in the line of battle.

For distance scouting duty we can find nothing superior to our fast transatlantic liners. Armored cruisers should be selected, invariably, as scouts for the battle-fleet, because, after locating the enemy, it may devolve upon them to bring on the engagement; or in the case of a retreating enemy their duty may be to harass and detain the enemy until the battle-fleet arrives to give the crushing blow.

The statement that armored cruisers should form a part of the battle-fleet cannot be contested, and, therefore, they should be designed for that service and be able to deliver and receive "hard knocks," and to manœuver with great celerity. Battleships will constitute always the main line of battle, and we must look to them to bear the burden of the offensive and defensive work. For this reason we should devote all our energies to building powerful and efficient battleships, not battleships which are the equals of those of other countries, but which are superior in gun-fire, in endurance, and in armored protection. Why should we sacrifice armor, armament and endurance to higher speed. Build a battleship with complete armor protection, carrying a heavy battery and capable of maintaining a sea-speed of eighteen knots, and we shall have the ideal vessel. A sea-speed of eighteen knots will not require a sacrifice either of armor or armament, but if we strive to

obtain a higher speed in a battleship, the fighting qualities must suffer necessarily.

To my mind, the batteries of our battleships should be increased, and I will repeat here what I stated in a paper published in the PROCEEDINGS in March, 1898:

"The most important subjects in battleships are the armament, armor and ammunition supply; and all else, excepting the engineering department, must be sacrificed for these three main fighting qualities.

"When the United States Government commenced building a navy, the policy was to have her ships armed with *more guns* and with guns of *greater range* than were carried by the war vessels of other nations. That policy was carried out in our early wars, and history records the splendid victories, and these victories were made possible by the large number of long-range guns carried by our ships.

"Up to the time of designing the battleships that are now on the stocks, our uninterrupted policy had been to build ships that excelled in battery all foreign ships of the same class, and our Oregon class maintain this policy, as their eight-inch guns far outclass the six-inch guns of foreign battleships. The Kearsarge and Kentucky are somewhat doubtful about maintaining our cherished policy, as many look upon their superimposed turrets with a skeptical eye. However, in our latest battleships we have completely abandoned the policy that we had held to for a century, as these ships are designed to be the *equals* of foreign battleships in armament, gun for gun, and *not superior* to them. We have abandoned the splendid eight-inch guns which made our Oregon class superior in armament to any ship afloat, and now we have nothing but six-inch guns to back up the thirteen-inch. I think this is a very unwise departure from the policy that always brought us victory in our past wars; and should our Alabama class engage with ships of the same class I fear that the victory would hang in the balance, while it would be insured had our ships been given the eight-inch guns. I consider the forty-caliber eight-inch gun a superb piece of ordnance, and one that we can ill afford to dispense with in our battleships, although I do not commend the eight-inch turret mounts in the Oregon class. Those turrets simply invite disaster, as they are perched high in the air, with only a four-inch armored ammunition tube underneath them for protection.

"It appears that the tendency in the British navy, and I regret to say in our navy, is to reduce the number of guns and to increase their arcs of fire, and also to have no guns above six-inch caliber for supporting the twelve- or thirteen-inch. This method of decreasing the number and caliber of guns is an ideal theory for reducing weights; *but ships are built to carry guns and to fight*, and it would seem better to reduce weights elsewhere than in the battery and ammunition. A comparatively small number of guns are thus placed on board our new battleships, and each gun commands a large arc of fire; but the theorist does not consider the fact that one shot may disable a gun, and then a large arc is without a gun to cover it. I believe in a large number of

guns with reduced arcs of fire, for then you will have more guns in proportion at all stages of the battle, and, if necessary, the ship can be manœuvred to bring the last guns to bear. If every gun in the ship's armament is to have an extensive arc of fire, then it is impossible to carry many guns, and when these few are disabled the ship is defeated. I do not see how a battleship can have *too many guns*, even if they are placed side by side; and to me it seems a sin to build a great battleship of 12,000 tons like the Alabama and give her a main battery of only four thirteen-inch and fourteen six-inch rifles.

"In the present age, when heavy fighting ships cruise in fleets, naval engagements between single ships will be rare; consequently, during battle, each ship of a fleet will have no trouble in finding enough of the enemy's ships to serve as targets for all the guns of her battery, and there need be no fear of some guns not bearing on the enemy's vessels. Therefore, I claim that the ship that mounts a large number of guns with small arcs of fire will be superior to the ship with fewer guns and large arcs of fire. The former vessel will be able to deliver many more pounds of metal against the enemy's various ships; and contests between fleets of battleships will be decided by the weight of shell thrown by guns of 6-inch caliber and above. Consequently, when we abandon the 8-inch guns in our new battleships we surrender the great advantage that we have always maintained over foreign ships, and we reduce our armament to the same plane as theirs. We should endeavor to retain the 8-inch guns in our broadside, because, like the past, the naval engagements of the future *will be fought with broadside fire* and not with a fore and aft fire.

"In an engagement between battleships of similar armor and displacement, which one will probably be the victor? There can be but one answer; for it will be the one that effectively delivers the greater amount of steel against the other ship. Give us guns galore, for the time will come when each gun will give a good account of itself, and our terrific broadsides will bring us victories as they have in the past.

"Let us hope that our battleships of the future will have complete armor protection; that the armor-belt will be in the right place when in war-time cruising trim; that they will not be burdened with so many boats and other peace-time encumbrances; that the 12-inch or 13-inch guns will be supported by 8-inch guns *en barbette;* that the rapid-fire battery of 3-inch guns will be increased, and that reserve forces of men and officers will be assigned to each ship, for then we shall possess ships which we can truly call battleships, as they will be able to stand up and give battle to anything that sails the seas under all conditions of wind and wave.

"In time of war the officers of the ship, and not her designer or builder, are the ones to be held strictly accountable for the fighting condition of the ship and for the result of battle, and it will be too late then to attempt to excuse defeat by attributing it to errors in the design, in the armament, in the ammunition supply, or in the practical equipment of the ship. Therefore, I believe that healthy criticisms and practical

suggestions by the sea-going officers who man our battleships and fight the guns should be very acceptable to those in authority who create our naval policy; and also to those who are entrusted with the work of designing and constructing our great national defenders, and who have not the opportunity of observing the practical behavior of these ships at sea."

Consider seriously the recently designed battleships of the Italian navy, which carry three 12-inch and twelve 8-inch guns in the main battery, on a displacement of 12,600 tons. What a superb and homogeneous battery we would have in our battleships of 15,000 tons, if we should give them four 12-inch, fourteen 8-inch, and twenty 3-inch rifles. A fleet of such ships would prove, in its power and homogeneity, invulnerable and superior to any fleet in the world.

As a final answer to Mr. Taylor's questions, my building policy would be as follows:

Build a moderate number of destroyers and torpedo-boats, and do not put torpedo-tubes in any other class of vessels. Build a large number of light-draft gunboats; do not build any protected cruisers; do not build any Marylands, but build a few armored cruisers (about one to every four battleships) of 9000 tons or less displacement, and carrying 8-inch and 3-inch rifles; build a large fleet of battleships and devote our main energies to building them, but let our Virginias be thickly and completely armored, carry four 12-inch, fourteen 8-inch, and twenty 3-inch rifles, have eighteen knots sea-speed, and have large coal and ammunition capacity. Man a fleet of such battleships with the personnel of our navy, and the Government may feel well assured of success.

Further discussion is invited.

REPLY TO DISCUSSIONS IN NO. 96, ON PAPER ENTITLED "TORPEDO OPERATIONS IN NAVAL WARFARE," PUBLISHED IN NO. 95.

Lieutenant L. H. CHANDLER, U. S. N.—It had been my original intention not to reply to criticism, fearing to weary the INSTITUTE'S readers, but owing to the fact that considerable new matter has been presented in the discussion, I cannot refrain from expressing my opinions in regard to certain parts of it. While I appreciate highly the attention that has been given to the lecture, I cannot attempt at this time to reply to everything that was presented in the discussion, but will devote myself in the main to three principal points brought out by Captain Goodrich, Lieutenant-Commander Chambers, and Lieutenants Ellicott and Hood. In so doing I wish to thank all for the courtesy with which they have treated my efforts and for the useful and interesting ideas that have been advanced. My not replying to all of them is due to lack of opportunity and not lack of inclination. I may say to all, though, that I hope the time will soon come when we will be allowed to work out our differences together upon the water instead of on paper. Until that happy time, I know of no more instructive pastime than these present discussions.

The three principal points in the discussion to which I have already referred as being of the greatest interest are as follows:

(*a*) The question of torpedo fire at a pursuing vessel from tubes aboard a heavy ship, as suggested by Lieutenant-Commander Chambers.

(*b*) The question of the coast district system as raised by Captain Goodrich.

(*c*) The theory of section attack as against "dispersion for search; concentration for attack," as criticised by Lieutenants Ellicott and Hood and epigrammatically characterized by the former.

These three topics will be touched upon in the order named.

(*a*) Torpedo Fire at a Pursuing Vessel from Tubes Aboard a Heavy Ship.

I am free to confess that Lieutenant-Commander Chambers has furnished me with a number of ideas that had not occurred to me before, several of which I am very glad to incorporate as a foundation for a change in one of my beliefs. I have found in these remarks a valuable use for the torpedo from big ships that had not before held a place in my mind.

I wish to say, first, that I quite agree that a shop adjustment of the gyroscope is mechanically possible and will no doubt be reached before long, and that when it is reached the usefulness of the weapon will be greatly increased. While this will render the torpedo far more formidable, especially as used from heavy ships, at the same time I do not believe that it will very greatly extend the radius of action of torpedo vessels, and that such craft will always have to work from some sort of base, fixed or movable, but in any event said base must be in still water.

As far as the question of setting tubes and gyroscopes aboard boats is concerned, I am of the opinion that the setting proposed by Lieutenant-Commander Chambers would not be so good as that proposed in my lecture. It seems to me that we can at least assume an ability on the part of each boat to head for an enemy long enough to discharge the three torpedoes, and by Lieutenant-Commander Chambers' setting the use of one torpedo is practically sacrificed to the idea that the target cannot be held for a time on a right ahead bearing. For any kind of retreat, either by passing or by turning immediately after fire, it seems to me that to bring the enemy right ahead until the fire is delivered is the only possible manner of getting the best results.

It will be noted in Section 27 of my lecture that, although not specifically mentioning the retreat by passing the enemy, I leave that question as a doubtful one. This whole matter is one that only practical experience can decide, and I look forward with eagerness to the time when we will be able to do tactical boat work under the guidance of officers who have had both theoretical and practical education in torpedo warfare prior to any manœuvres which may be undertaken to prove or disprove the theories that I have set forth. The manœuvres at Newport, last summer, to which I shall refer later, were carried on by men who had practically none of them ever done any such work before, as I think I am safe in saying that there is hardly an officer or man in the

Navy who had had up to that time much experience of the kind. I include myself among the number of inexperienced ones most unreservedly. I therefore claim that the work became almost entirely an instruction to individuals, and much was learned from it. We all discovered how prone a torpedo-boat officer would be to mistake his distance and fire when far outside of torpedo range, etc. Of course all these points were of the utmost value to us, but I claim, and I think I will be upheld in the claim by the service at large, that in order to prove or disprove tactical theories, the manœuvres must be conducted by men who are already adepts in these A, B, C matters which came as surprises to us all at Newport. In other words, the work done there was excellent for purposes of elementary instruction, and a number of nights of it would make torpedo-boat officers sufficiently familiar with surrounding conditions to enable them to go ahead and develop theories in regard to the tactics of attack and retreat. I hope we may soon have the chance to do this.

TABLE SHOWING RANGE AT WHICH A TORPEDO CAN BE FIRED AND HIT AN ENEMY IN DIRECT PURSUIT.

Speed of pursuing enemy, in knots per hour.	Torpedo tactical diameter 300 yds.				Torpedo tactical diameter 600 yds.			
	Speed of torpedo in knots per hour.							
	15	20	25	30	15	20	25	30
	Range at which to fire to hit.							
12	671.5	583.7	522.9	489.1	1343	1167.4	1045.8	978.2
13	702.5	607.4	541.5	504.9	1405	1214.8	1083.0	1009.8
14	733.5	631.1	560.1	520.7	1467	1262.2	1120.2	1041.4
15	764.5	654.8	578.7	536.5	1529	1309.6	1157.4	1073.0
16	795.5	678.5	597.3	552.3	1591	1357.0	1194.6	1104.6
17	826.5	702.2	615.9	568.1	1653	1404.4	1231.8	1136.2
18	857.5	725.9	634.5	583.9	1715	1451.8	1269.0	1167.8
19	888.5	749.6	653.1	599.7	1777	1499.2	1306.2	1199.4
20	919.5	773.3	671.7	615.5	1839	1546.6	1343.4	1231.0
21	950.5	797.0	690.3	631.3	1901	1594.0	1380.6	1262.6
22	981.5	820.7	708.9	647.1	1963	1641.4	1417.8	1294.2
23	1012.5	844.4	727.5	662.9	2025	1688.8	1455.0	1325.8
	Tor. runs 471.43 yds., in a 180° change of course, in given times. At 30 knots in 28 seconds. " 25 " 33 " " 20 " 42 " " 15 " 55 "				Tor. runs 942.86 yds., in a 180° change of course, in given times. At 30 knots in 56 seconds. " 25 " 1 min. 6 secs. " 20 " 1 " 24 " " 15 " 1 " 50 "			

Lieutenant-Commander Chambers makes one statement that I must take exception to, and that is where he says of the gyroscope adjustment that "the adjustment is simple and can be made almost instantly at the side of the tube, etc. . . ." This I challenge. Mr. Chambers is thinking of the above-water tube, which is now practically abolished, and, I believe, properly so, from heavy ships. With the submerged tube no such method of setting has as yet been designed, and its accomplishment is surrounded by many difficulties. So, for the present, I cannot accept the above statement relative to this point, for I consider the dis-

cussion of above-water tubes for heavy ships as practically useless, and so confined myself in the lecture to the new Maine class of ships with submerged tubes only.

Passing from these somewhat discursive matters to the question at issue—that of torpedo fire at a pursuing ship—I must admit that I am thoroughly in accord with all that Lieutenant-Commander Chambers says. The approach from astern by a faster ship that desires to ram is very apt to occur, and can, of course, be always brought about by the attacked ship.

If, therefore, the attacked ship causes her pursuer to follow directly after her, the stadimeter may be used to determine the exact speed of the pursuer, as well as her distance at any given moment.

The foregoing table could, therefore, be used to determine with the utmost accuracy the proper elements of fire for a style of defense that would make the pursuer very unhappy.

From this table will be seen how vastly this method of fire increases the effective range of the torpedo, by allowing the pursuing ship to cover part of the intervening distance herself. It will also be seen that the greater the tactical diameter of the torpedo and the less its speed the further apart the two ships could be at the moment of fire and still score a hit. Thus we see qualities that are ordinarily classed as disadvantages in the torpedo, slow speed and great tactical diameter, are here qualities of positive value. The limit would of course be that the run must be made quickly enough to prevent the enemy from seeing and avoiding the torpedo. Unless the sea is dead smooth, however, it is very hard to follow the track of an approaching torpedo, and with a double fire from the foremost ship resulting in a torpedo approaching on each side, dodging would be a very hard matter.

In this connection, I am much impressed by the facility with which this method of torpedo attack could be used in conjunction with the system of concentration of gun fire, recommended by Professor Alger in his treatise on the "Errors of Gun Fire at Sea." A ship which follows his method of steaming in a spiral in order to keep an enemy in his zone of maximum gun fire, could readily resort to this method of torpedo warfare if desired. To bring the enemy astern long enough to deliver the torpedo fire by the use of the above table would be very easy, and perhaps a similar table for torpedo fire while still on the spiral might be prepared also. This would of course be preferable, and while the preparation of the table would seem at first blush to call for an application of more than simple mathematics, at the same time such a table, if it can be prepared, would be about as simple to use after it is once prepared as the one given above. As yet I have not had time to inquire into this point very fully, but promise myself to do so at the first opportunity.

To fit torpedoes for use with this table, there will have to be furnished with each torpedo a tabular statement of the number of turns of the regulator to secure any one of the given speeds on the semi-circumference of the circle; also some arrangement must be made for securing

the desired tactical diameter. To do this I believe two sets of vertical rudders could be filled, capable of being readily inserted in the tail blades or removed from them as desired. The larger set could be used for a 300-yard diameter, and the smaller one for a 600-yard one. These two points present no difficulties that could not be readily overcome at the torpedo station.

(*b*) The Coast District System.

In replying to Captain Goodrich's objections to my system of coast districts, I wish to state, first, that it has never been my idea to free the torpedo sections from the control of the commander-in-chief or senior officer present in time of war, as I of course realize the foolishness of any such proposition. My only idea in regard to protecting the sections from commanders-in-chief and casual senior officers present in time of peace, was to enable the torpedo-boat officers to continue their proper work without having their boats called upon at the pleasure of any passer-by to run errands, carry despatches, transport wash-clothes and marketing, etc. That the danger of this improper diverting of boats from their true duties is no imaginary one is proved by the fact that they have always been used for such purposes far too freely, even during the Spanish war, and I fancy no one will doubt what would be their fate in the matter in time of peace unless amply protected by departmental orders.

Captain Goodrich in his criticism, as well as in a previous one on my essay of January 1, 1900, objects to my coastwise district system as a division of force to be deprecated. The comparison of my scheme with the Jeffersonian gunboats is, in my opinion, not a fair one, for the gunboat scheme was to have those small vessels in the various ports and *no other naval force anywhere.* I certainly have never advocated the coast torpedo-boat system to the exclusion of all other force afloat.

The coast system as I devised it was to furnish at any point a well-trained force of torpedo vessels, with officers thoroughly familiar with the locality, upon which the commander-in-chief of the fleet in being could freely call for whatever war service they could render him. With our tremendous length of coast-line, I can see no other way in which this can be done.

Captain Goodrich criticises my system because it divides the force. True, and I am the first to admit that a smaller force with the fleet would answer every purpose, *provided such force could be kept in efficient condition* and still cruise with the fleet. His criticism is a tearing down of the system which I evolved, and the reasons given for it have much weight, even in my own mind, but I am constrained to advance the point that while Captain Goodrich has torn down my structure, he has not, in either of his criticisms, erected anything in its place. I should be more than glad to hear what his ideas on the subject are, and exactly how he thinks the boats should be kept in being.

If any inference can be justly drawn from his remarks, it is that the boats should serve with the fleet regularly, as a component part thereof. I leave the possibility of this to the judgment of individuals. Personally,

I am confident that were it attempted we would have boat after boat left behind for repairs, with officers and men played out and machinery broken down, until the smaller force that Captain Goodrich considers all that is necessary would have accomplished a more thorough dispersion than any dreamed of in my system, and with this difference, *that his fewer boats and men would be broken down,* while my greater number of boats would be in prime condition, with officers and men physically sound and keen for the encounter.

That my system will demand more vessels is true, and my table gives 231 as a maximum. With far less coast-line than our own, England has 96 destroyers and 165 boats, making 261 in all, with 13 more boats owned by her colonies; France has 31 destroyers and 277 boats, making 308 in all, with 10 submarines besides; and Germany has 154 in all. These figures are taken from the only edition of Clowes' Naval Pocket-book that I have at hand, that corrected to February 1, 1899, and must undoubtedly be considerably increased to bring them up to date. Considering these figures, with relation to the comparative needs for defense of these countries and our own, I am content to leave the question as to whether or not my figures are excessive to those who read.

(*c*) The Theory of Section Attack as against "Dispersion for Search; Concentration for Attack."

The question of group search and dispersed attack is one to be solved by practical work alone. This I admit. I long to see officers and boats given a chance to work it out under proper conditions.

I am well aware that if the boats could be given "dispersion for search" and "concentration for attack," to quote Lieutenant Ellicott's final words, the maximum efficiency would be obtained, but does his method as proposed accomplish it?

As I understand it, his idea is to take the force at his command, say two sections, fourteen boats, and turn them loose separately, each boat to be at a certain place somewhere out on the water in the dark, at a certain time. There will be no means for a man in command of a boat to tell when he is in his place, except it be so close to the shore as to enable him to recognize the land, for certainly light-houses, etc., will not be available.

Then the boats, each being in a supposed place (fourteen watches to coincide, and no mistake made in estimate of time to reach a given unmarked spot), they are all to steam in at slow speed towards another supposed spot, and in case any one boat sees anything, she is to trust to luck to get more boats to help her concentrate on it. When done, the victim will more than likely prove a friend also. With the experience born of one night's prowling, I am willing to stake my reputation on the difficulty of telling whether a certain dark mass in view at night is an enemy's battleship or a friend's torpedo-boat.

I believe that no greater confusion worse confounded could be secured than by the method recommended in these two criticisms.

The idea of going out and annihilating an enemy's whole fleet in one night is attractive, but, to me, chimerical.

The time element must be eliminated to the utmost degree possible. One boat alone has very little chance with a battleship even under the best of circumstances. These are axioms to me.

To avoid depending on the time element, and to ensure that more than one boat shall attack the enemy at the same instant, the officer in command must hold his boats together until the last moment. This the wedge formation accomplishes, and while it does render finding the enemy more difficult, it may be said that if an enemy cannot be found in that way, in say a week, it would seem to me that his blockade must be rather a farce.

So that while I admit that all Lieutenant Ellicott urges against the group search in his (*a*), (*b*) and (*c*) is true (boats must go slowly when in vicinity of the enemy to minimize (*b*)), at the same time I dissent utterly from his finding on the premises. The disadvantages that he urges, must be submitted to in order to accomplish anything. I am confident that the haphazard concentration he suggests would, if relied upon, simply result in the destruction of the boats in detail. Remember, they must avoid or run over pickets, etc. Seven boats, or even five, if they can get anywhere in the vicinity of a ship, can, in my opinion, run through the best picket force available, and while some of them are drawing the enemy's fire the rest can get a chance to fire their torpedoes. In other words, one battleship and her pickets could probably hold up one, two or three boats before any of them could deliver their torpedo fire, but if five, six or seven go in together, I do not believe that any human power could stop them all outside of torpedo range.

Although doing so will perhaps furnish my opponents with arguments against what I have just set forth and in favor of the dispersed search idea, I nevertheless desire to give an account of the conclusions I drew from the Newport manœuvres of last summer.

These manœuvres were originally intended to cover a week's time, but were from various causes cut down to two nights. Then, in order not to wear men out, the operations on those nights were all ordered to be terminated by midnight the first night and by eleven o'clock the second. As torpedo work depends to an exceedingly large degree on the nervous strain and physical exhaustion under which the enemy is kept for perhaps many nights prior to the real attack, and upon the element of surprise, it will be seen at once that the orders just quoted at once deprived the torpedo-boats of practically all the natural advantages that would ordinarily militate in their favor. Please keep these conditions in mind in reading what follows, and allow for the tremendous loss of efficiency that necessarily resulted to the boats from their enforcement.

The first night of the manœuvres was given up to a spectacular passage of the Newport forts by a squadron of battleships, prior to which the torpedo-boats had been sent in to attack the inside ships. This was ordered to be done between eight and twelve at night, and on a particular night. Naturally the boats were discovered and mostly put out

of action. They had orders to steam in anyhow, to save time, regardless of whether they were discovered or not, so that if a torpedo-boat officer discovered that his foes were on the alert at a particular point, instead of turning and trying another, as a man would do in time of war, he was forced by order to push ahead and sacrifice himself under the guns of forts and ships in order that the crews of the battleships could be allowed to get to sleep at midnight. Certainly true tactical considerations never dictated these conditions. As it was, one boat, the Stiletto, got in and torpedoed the Massachusetts. The Holland was not allowed to participate in this night's work, the reasons for which I do not know.

On the second night the boats from inside were to go out and attack a blockading fleet. My claim is that the sensible thing to do in war time would have been to send the boats out together (there were but five, and a fine miscellaneous collection at that) and be content to get one of the enemy's heavy ships in a single night, and to leave the rest for another time, rather than to risk having the boats cut off in detail while skurrying around separately and before they could accomplish anything.

However, torpedo stock has been at a low ebb for some time in our navy, and at these manœuvres it would have been a fatal blow to the torpedo service had five boats only succeeded in getting one battleship on this occasion. Officers of the navy and the newspapers of the country would have joined together in crying out at the failure of the boats. I therefore believe that it was a wise comprehension of what I may call the politics of the occasion, and not any tactical consideration, that caused the attack to be delivered as it was.

Commander N. E. Mason dictated the method of attack, and I am confident that in time of war he would have carried out what I state to be the correct tactical method, but as it was in response, I believe, to the political considerations indicated only, he wisely abandoned sound war tactics and separated his boats.

The general plan of operations was laid down by the battleship officers again, and compelled the boats to finish their work by eleven o'clock in the evening, and on one fixed evening at that. These limitations themselves seemed almost enough to prevent the boats from doing anything. Being bound down in regard to time as he was, Commander Mason very shrewdly sent the boats out at dusk, and before the five ships outside were expecting an attack the Vicksburg and Scorpion (rated battleships for the occasion) were declared sunk and sent into port.

The Holland was out that night also. Personally, I was aboard the Porter.

The search for the Kearsarge, Indiana and Texas was then continued. I believe that one of the boats (the Dahlgren, I think) found the Indiana and claimed to have sunk her, but that next day the umpires decided that the Indiana had sunk the boat. Nobody else saw the Indiana that I am aware of, and, as far as I know, she was so far to the eastward as to be of no use in a blockade of Newport.

At about 8.30 the Porter sighted a ship (the Kearsarge) and made for her, but before our attack could be made another boat (the Dahlgren) attempted her and was successful. Not knowing the result of this, the Porter made sure by continuing her effort and succeeded. At about the same moment the Holland attacked and also scored a success. Captain Folger answered the Porter's hail by saying that he had been successfully attacked, and turned on his lights and steamed in to an anchorage. The decision of the next day in regard to this engagement was that as the Dahlgren had been previously sunk by the Indiana she therefore did not sink the Kearsarge, and that as the Kearsarge considered herself sunk by the Dahlgren, therefore the successful attacks of the Porter and the Holland did not count. There is no question, and none was ever raised, that three successful attacks on the Kearsarge were made almost simultaneously by these three boats, and under every rule of justice she should have been declared sunk, as her commanding officer thought her to be, but the Indiana-Dahlgren controversy was allowed to render invalid the just claims of the Porter and Holland.

These operations for the moment disposed of three out of the five ships of the blockading force, during which manœuvres and prior to the attempts on the Kearsarge above related, the Gwin and another boat were put out of action, I believe, by the Kearsarge. The Dahlgren supposed she had put out the Indiana, but nothing more was seen of that vessel by any one until after the time limit expired.

After leaving the Kearsarge, an effort was made by the Porter to find the Indiana and Texas, and we are confident at its end that neither of these vessels was in such a position as to cover Newport harbor. The Fall River boat, a blaze of light, came out of Newport just after the Kearsarge incident, and the Porter steamed out to sea on a course parallel to hers and about four miles east of her, knowing that if there were a battleship anywhere between the steamer and herself an eclipse of the steamer's lights must ensue. There was no such eclipse, and after steaming down almost to Point Judith buoy that effort was given up.

Having but a half-hour left, the Porter steamed to the fairway, outside Brenton's Reef, and lay still in the channel, waiting for one of the two ships to come in, hoping they would do it before eleven o'clock. At about 10.40 the Texas was sighted heading directly for the Porter, and had time served we had but to lie still until she was within torpedo range, for, with the boat still in the water as she was, she was quite invisible, and the Texas was not using her search-lights.

However, the short time available prevented our doing this, so we steamed slowly towards her, and were just in position to make the rush when she struck six bells and turned on her running lights.

The net actual results of the night were three out of five ships sunk, with a loss of two out of five boats. The umpire's decision next day lost the Dahlgren and saved the Kearsarge. The two remaining ships of the blockading force had gone so far to sea as to render them of little value to the blockade.

It will doubtless be maintained that these results are arguments for the scattered search principle as against my own, but I believe that the single-boat attacks which succeeded here would have resulted in disaster in real service. The inner ships were to have sent in picket-boats, but the torpedo-boats got out before this was done and caught the inner ships unawares. This would hardly be done in warfare. And with proper pickets to designate the direction and time of approach of a boat I do not believe that a single boat would be able to get far, whereas the seven, scattering upon alarm by the pickets, would create such a flurry from so many directions, that success would be more than likely in spite of the pickets.

Like David Harum I am always willing to give the other fellow a show, and under these circumstances if I could trade off two or three boats for one battleship, I would be content to call it a good night's work and to leave the enemy a few stray vessels here and there for a future occasion, instead of devastating his entire fleet in one fatal attack by pitting single boats against single battleships.

The fact that the Dahlgren, Porter and Holland all tried for the Kearsarge at about the same moment looks at first blush like a support of the accidental concentration theory of Lieutenant Ellicott, but when the facts are all borne in mind I hardly believe this will be accepted as true. There were no pickets out, two of the blockaders had gone into port over an hour before as sunk, two others had gone so far away that there was no possibility of finding them within the time limit, with a result that the Kearsarge was left alone in her glory to bear the whole brunt of attack. Part of the boats had gone out to the westward and worked to the eastward, and the rest went out to the eastward and worked to the westward. That we three met the Kearsarge at the same time in the middle is no wonder, and proves nothing to me.

In other words, I claim that as far as torpedo work was concerned, these manœuvres gave us all some fine elementary instruction that we sadly needed, but that as far as proving or disproving any tactical theories was concerned they were of the very slightest value. If persisted in much will eventually be learned by such exercises, but to be of value absurd time limitations must be done away with, day-time drills must be abolished for the time being, the elements of fatigue and surprise must be allowed to play their full part, and all night work and all day sleep must be the rule. All hands on deck from eight to eleven and then "Hurrah for our hammocks" is a wonderfully poor assimilation to war conditions, and if we are to learn anything from manœuvres that cry must be done away with once and for all.

PROFESSIONAL NOTES.

Prepared by Lieutenant L. S. VAN DUZER, U. S. Navy.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

AUSTRIA.

BUDGET.—The budget for 1901 amounts to 43,490,820 crowns ($8,828,636.46; 1 crown = $0.203). The ordinary charges are placed at 28,521,660 crowns ($5,789,896.98), an increase of 2,965,610 crowns as compared with 1900; while the extraordinary charges are 14,969,160 crowns ($3,038,739.48), an increase of 1,058,710 crowns. The ordinary charges include, in addition to other items, the following: Last instalment for the construction of the torpedo cruiser Aspern (ex-B), of 2350 tons; third instalment for torpedo cruiser Szigetvar (ex-C), of 2350 tons; second instalment for armored cruiser E, of 7400 tons, to replace the Radetzky; last instalment for small mine-tender of 200 tons; and first instalment for battleship A, of 10,000 tons, to replace the Laudon. The extraordinary charges include items for armaments and ammunition for ships building, mines, torpedoes, torpedo nets, coaling and mine stations, magazines, gun-cotton, etc., also the following: last instalment for the armored cruiser Kaiser Karl VI (ex-D), of 6250 tons; fourth instalment for the Habsburg (Battleship I), of 8340 tons; third instalment for battleship II, of 8340 tons; and second instalment for battleship III, of 8340 tons.

BATTLESHIP A.—The plans for this battleship are still under consideration and no details are yet given out. The displacement will be about 10,000 tons.

ARMORED CRUISER E: PRINCIPAL DETAILS.—This vessel will be of the Kaiser Karl VI type, but longer, and is reported to have been laid down in the latter part of 1900.

Armament—Two 24-cm. (9.45-inch) Krupp guns in turrets, one forward, one aft. Ten 15-cm. (5.9-inch) Skoda guns in casemates. Twenty-five smaller guns. Torpedo tubes.

Protection.—Belt, 8.7 inches. Turrets, 7.9 inches. Casemates, 5 inches.

Motive power.—Twin-screw, triple-expansion engines. Yarrow water-tube boilers. Designed I. H. P., 12,300, to give a speed of 21 knots.

Dimensions.—Length, 383.75 feet; beam, 61.66 feet; mean draft, 21.3 feet; displacement at this draft, 7400 tons (metric).

HABSBURG: LAUNCH, DESCRIPTION.—This second-class battleship was launched at the San Marco (San Rocco?) Yard of the Stabilimento Tecnico Triestino on September 9, 1900. She is the first of three sister ships now under construction. The hull is of steel without sheathing. Wood is used as little as practicable; the upper (over superstructure) and main decks are planked but the others are covered with linoleum or corticine. The poop and forecastle are both continuations of the main deck; between

them is a superstructure which is decked over and surrounded by bulwarks of good height. The freeboard at the stem is about 19 feet and at the stern about 18. There are two smokepipes and two military masts. Electricity will be used for lighting the ship; also for working the guns, ammunition hoists, ventilating machinery, etc. The electric plant will consist of 6 three-phase dynamos.

Armament.—Three 24-centimeter (9.45-inch), L. 40, Krupp guns of so-called R. F. type: two in a closed balanced turret forward and one in a similar turret aft. Twelve 15-cm. (5.9-inch), L. 40, Skoda guns: six each side in two-story casemates, the lower story on the gun deck, the upper one on the main deck in the superstructure. The four forward guns can fire directly ahead and the four after ones directly astern. Ten 6-pounders: four each side on the superstructure and one each side on the gun-deck forward. Twelve 1-pounders and eight machine guns. (It is not yet definitely settled whether the small guns will be as described or whether the 6-pdrs. and 1-pdrs. will be replaced by 24 3-pdrs.) The ammunition hoists are electric and lead directly from the guns to the magazines and shell rooms. Height of axes of guns above load water-line: forward turret guns, 25 feet; after turret guns, 24 feet; casemate guns on gun deck, 14.7 feet; casemate guns on main deck, 21.3 feet. All except the turret guns are furnished by the Skodawerke, Pilsen. The torpedo armament consists of two submerged tubes for 45-cm. Whitehead torpedoes.

Protection.—Belt, 8.7 inches thick, extending about two-thirds the length amidships and enclosing the bases of the barbette towers (or loading tubes—they are small for towers and very large to be styled loading tubes). The main belt extends to 4.3 feet below the load water-line and 3.5 feet above it. Beyond the belt, 2-inch armor of the same width extends to the stem, being widened at the extreme end, where it descends to cover the ram. Above the belt, 4-inch side armor of the same length extends to the gun deck. The ends of the belt and side armor are joined by vertical bulkheads rising from the protective deck. The latter is 2.3 inches thick forward of the belt and 2.6 inches abaft it; the middle protective deck is flat, resting on top of the belt, and is 1.8 inches thick. The turrets for the heavy guns are 8.4 inches thick with 7.2-inch barbette towers. The casemates are 5.4 inches thick on the outboard sides and 3.5 inches on the inboard. The forward conning-tower is 8 inches thick with 6-inch communication tube; the after one is 4 inches, with a 2-inch tube. The armor is of chrome-nickel-steel, face-hardened by the makers' own special process, and is furnished by Witkowitz and Company, who have supplied all the recent armor for the Austrian Navy.

Motive power.—Twin-screw engines of 11,900 (estimated) I. H. P., designed to give 136 revolutions and a speed of 18.5 knots. Boilers, 16 Belleville. Coal capacity, 840 tons.

Dimensions.—Length, 354.25 feet; beam, 65.6 feet; draft, 23.3 feet; displacement at this draft, 8340 tons (metric).

The other two battleships of the Habsburg type are under construction, one at the government yard at Pola and the other, like the Habsburg, at Trieste.

SZIGETVAR: LAUNCH, DESCRIPTION.—This vessel is called a torpedo cruiser and is, in all essential respects, a sister ship to the Zenta and Aspern. The main deck is flush without superstructure, or raised poop, or forecastle. There are two light pole masts and two smokepipes. The hull is of steel, sheathed and coppered.

Armament.—Eight 4.7-inch Skoda guns: two on the main deck, one forward and one aft; six in broadside on the gun deck, three each side, the forward and after pairs in sponsons and capable of firing directly ahead and astern, respectively. Ten 3-pounders: three each side on the gun deck and four on the main deck, one over each sponson. Two machine guns. Two 17.7-inch torpedo tubes.

Protection.—Complete protective deck, 1.96 inches thick on the slope and 1.2 inches on the flat.

Motive power.—Twin-screw, vertical, 4-cylinder, triple-expansion engines and eight Yarrow water-tube boilers. The estimated I. H. P. with natural draft is 5000 and with forced draft 7000; the corresponding speeds being 17.5 and 20 knots. The coal capacity is 475 tons and the anticipated radius of action about 4000 miles at 10 to 12 knots.

Dimensions.—Length between perpendiculars, 302.8 feet; over all, 315.9 feet; beam, 39.4 feet; mean draft, 14.1 feet; displacement at this draft, 2350 tons (metric).

BRAZIL.

PERSONNEL.—A recent law of the republic has fixed the numbers of the various lists of effectives in time of peace. No change is made in the officers. The number of midshipmen and cadets is not to exceed 180; the number of enlisted men is fixed at 4700 and of apprentices at 1500, while the marine infantry will have 450 men. In time of war these numbers as well as those of all the other lists will be doubled.

DENMARK.

BUDGET FOR 1901.—According to the *Rivista Marittima* the Danish naval budget amounts, in the ordinary items, to 6,851,449 crowns ($1,836,188.37; 1 crown = $0.268) and in the extraordinary items to 214,000 crowns ($57,352). In the ordinary expenses, the sum of 5,164,469 crowns ($1,384,077.69) is for the navy proper and 1,586,980 crowns ($425,310.64) is for the expenses of the ministry of marine, dependent offices, schools, etc. There is an error of 100,000 crowns in these figures, probably typographical, but it is not possible to locate it with the information at hand. The expenses for the navy proper (apparently including the extraordinary charges) are divided up as follows: Ministry, 91,434 cr.; pay, 792,398 cr.; dockyard expenses, including material, 2,856,252 cr.; provisions, 40,134 cr.; sanitary service, 48,600 cr.; clothing, 62,917 cr.; barracks, 123,293 cr.; improvement of harbors, 35,000 cr.; schools of instruction, 116,308 cr.; equipment of ships, 1,002,400 cr.; miscellaneous, 93,228 cr.; pensions, 1146 cr.; hydrography, 32,390 cr.; school for enlisted men, 120 cr.; rent of quarters, 131,061 cr. Again we find a discrepancy of figures but they are sufficiently close for our purpose, which is to give a good idea of Danish naval affairs. Of the sum allotted to dockyard expenses, new construction accounts for 1,215,000 crowns, with which it is expected to continue the construction of the little battleship Herluf Trolle and of the mine boat Beskytteren; to commence another vessel of the Herluf Trolle class; to thoroughly repair and refit the armorclad Tordenskjold, the royal yacht Dannebrog, and the gunboat Guldborgsund. The extraordinary vote comprises 99,000 crowns for material "di sbarramento," 100,000 crowns for fitting out the Herluf Trolle, and 15,000 crowns for fitting out the Beskytteren.

FRANCE.

BUDGET AND PROGRAM FOR 1901-1907.—On February 6, the French Senate approved in its entirety the French naval budget which had already passed the Chamber of Deputies. The budget was approved by sections and much of it had been assented to some time before. On December 9, President Loubet promulgated the following law which formed a part of the budget:

"Art. 1.—The Minister of Marine is authorized to construct in the government yards, or by contract in private establishments, the ships hereinafter designated, of which the total cost is estimated at 526,836,000 francs ($101,679,348; 1 franc = $0.193):

6 battleships of 14,865 tons;

5 armored cruisers of 12,600 tons;

28 torpedo-boat destroyers of about 305 tons.

"In addition to these, there are authorized torpedo boats, submarine boats, and submergible boats, of which the number will be determined later; and of which the total cost is estimated to reach 118,300,000 francs ($22,831,900).

"Art. 2.—The credits relative to new construction provided in the budget for 1900, or authorized by the present law, are 762,212,000 francs ($147,106,916) and are to be expended before January 1, 1907."

This will be provided for each year in the ordinary expenditures.

"Art. 3.—The credits, or portions of credits, remaining unused at the end of any year will, before March 31 of the second year, be carried forward to the credit of the following budget."

The program herein outlined is to be completed by January 1, 1907; and the amounts to be spent each year are approximately as follows: 1901, 111 millions; 1902, 117 millions; 1903, 127 millions; 1904, 127 millions; 1905, 104 millions; 1906, 69 millions.

In accordance with this program it is expected that the following new construction will be commenced in 1901:

Two battleships of 14,865 tons; one at the arsenal at Brest and one in a private yard.

Ten torpedo-boat destroyers of the Fauconneau type (303 tons, 26 knots); two at the government yard, Rochefort, and eight in private yards.

Twelve first-class torpedo boats: one at the arsenal, Saigon, and eleven in private yards.

Eight submarine boats of improved Narval type; two at the arsenal, Cherbourg; six at the arsenal, Toulon. The length will be 34 meters; beam, 3.75 meters; displacement, 106 tons. This will make twenty submarine boats building or completed.

VESSELS BUILDING.

Name.	Displacement (tons).	Where building.	Remarks; date of completion.
New battleship	14,865	At a private yard.	Not yet ordered.
"	14,865	Arsenal, Brest.	To be laid down.
Suffren	12,728	"	Launched; compl. 1902.
Iena	12,052	"	Having trials; compl. 1901.
Henri IV.....	8,948	Arsenal, Cherbourg.	Launched; compl. 1902.
Armored Cruisers.			
Jules Ferry	12,550	Arsenal, Cherbourg.	Ordered; keel not laid.
Leon Gambetta.....	12,550	Arsenal, Brest.	Ordered; keel not laid, but to be laid soon: to be launched end of 1901.

VESSELS BUILDING—*Continued.*

Name.	Displacement (tons).	Where building.	Remarks; date of completion.
New ship	12,550	Arsenal, Toulon.	To be laid down this year.
Jeanne d'Arc	11,270	"	Lchd.: to be compl. 1901.
Gloire	10,000	Arsenal, Lorient.	Launched June 27, 1900.
Marseillaise	10,000	Arsenal, Brest.	Launched July 14, 1900.
Amiral Aube	10,000	Ch. de la Loire, St. Nazaire.	Not launched; compl. 1903.
Sully	10,000	Forge et Chantiers de la Mediterranée, La Seyne.	" "
Condé	10,000	Arsenal, Lorient.	Laid down Jan. 1, 1901.
Amiral Gueydon	9,516	"	Compl. this year possibly.
Dupetit Thouars	9,516	Arsenal, Toulon.	To be launched 1901.
Montcalm	9,516	F. et C. de la M., La Seyne.	Launched; compl. 1901.
Desaix	7,700	Ch. de la L., St. Nazaire.	To be launched soon.
Dupleix	7,700	Arsenal, Rochefort.	Lchd.; compl. Oct. 1902.
Kléber	7,700	Ateliers de la Gironde, Bordeaux.	Not launched; compl. 1903.
Protected Cruisers.			
Chateaurenault	8,018	F. et C. de la M., La Seyne.	Not yet delivered to govt.
Jurien de la Gravière.	5,500	Arsenal, Lorient.	Launched; compl. 1901.
Transport.			
Vaucluse	1,650	Arsenal, Rochefort.	Building; compl. 1901.
Torpedo Boat Destroyers.			
Pertuisane	303	Arsenal, Rochefort.	Launched.
Escopette	303	"	"
Flamberge	303	"	Just begun.
Rapière	303	"	"
Sarbacane	303	"	Ordered; not yet begun.
Carabine	303	"	" "
Arquebuse	303	A. Normand et Cie., Havre.	Compl. 1903.
Arbalete	303	"	"
Mousquet	303	"	"
Sagaie	303	"	"
Epieu	303	"	"
Harpon	303	"	"
Fronde	303	"	"
Javeline	303	"	"
Torpedo Boats.			
Trombe	185	Ch. de la Loire, Nantes.	Compl. 1901.
Sirocco	185	A. Normand et Cie., Havre.	"
Mistral	185	"	"
Simoun	185	F. et C. de la M., Havre.	"
Typhon	185	"	"
Bourrasque	150	A. Normand et Cie., Havre.	"
Raffale	150	"	"
Nos. 22 and 224	84	Arsenal, Cherbourg.	
Nos. 258, 259, 260, 261	90	Ateliers de la G., Bordeaux.	Compl. 1901-1902.
Nos. 243, 253, 254, 255, 256, 257	86 to 90	F. et C. de la M., Havre.	
Nos. 264, 265	90 (?)	Société Dyle et Bacalan, Bordeaux.	Compl. April, 1902.
Nos. 225, 226	84	Arsenal, Toulon.	Begun 1898; compl. 1901.
Nos. 245, 246, 247, 248, 249, 250, 261, 262, 263	86 to 90	Creusot Works, Chalons-sur-Saone.	Some nearly compl. etc.
No. 244	90	Arsenal, Saigon.	Compl. Jan. 15, 1902.
P96	?	"	Compl. 1903.
1 New first-class boat	?	"	To be laid down.
11 " "	?	In private yards.	Not yet ordered.

NEW BATTLESHIPS: DESCRIPTION.—These vessels will be more fully described in a later number of the PROCEEDINGS. The complement will be 42 officers and 751 men. The principal features are:

Armament.—Four 12-inch guns in pairs in balanced turrets forward and aft. Eighteen 6.48-inch guns: twelve in pairs in turrets; six in casemates. Twenty-six 3-pounders. Two 1-pounders. Five torpedo tubes, of which two are to be submerged.

Protection.—Complete belt, 12 inches thick at the water-line amidships. Above this a thinner belt, also complete, and 4 inches thick, rising to a height of 8.2 feet above the water at normal load. Complete protective deck 4 inches thick on the slopes. Main turrets, 11 to 12.5 inches thick.

Motive power.—Triple-screw, triple-expansion engines of 14,475 I. H. P. Designed speed, 18 knots. Normal coal supply, 905 tons; total coal capacity, 1825 tons.

Dimensions.—Length, 438.9 feet; beam, 79.5 feet; draft, aft, 27.5 feet; displacement, 14,865 tons (metric).

CONDÉ: KEEL LAID, DESCRIPTION.—The keel of this armored cruiser was laid at Lorient arsenal on New Years day, 1901. All of her sisters were begun some months before and two, the Gloire and Marseillaise, have been launched. The hull is of steel, without sheathing. There are four smokepipes; one military mast forward with two tops; signal mast aft with one small top. The upper deck extends nearly to the stern so that the after turret is at the same height as the forward one. The complement is 23 officers and 540 men. The principal details are:

Armament.—Two 7.6-inch guns in turrets, one forward, one aft. Eight 6.48-inch guns: four in turrets on the upper deck, two each side amidships, about 60 feet apart; four, singly in casemates, one sponsoned out each side on the main deck abreast forward smokepipe, giving fire directly ahead, and one each side on berth deck abreast mainmast, giving fire directly astern by recessing the port. Six 3.9-inch guns: two on upper deck in forward superstructure and above forward pair of 6.48-inch guns, with fire directly ahead; two on main deck above after 6.48-inch casemates with fire directly astern; two on main deck amidships between bases of 6.48-inch turrets. Eighteen 3-pounders: four in the tops, four on each side on berth deck amidships, one each side on main deck forward, and the rest on the upper decks and bridges. Six 1-pounders. Two 2.56-inch boat and field guns. Two 17.7-inch torpedo tubes. Six searchlights: one each side in ports near the stern, one each side in ports near stem, one at foremasthead, and one on low platform on mainmast.

Protection.—The water-line armor belt extends from the stem nearly to the stern. It is 6.7 inches thick amidships, 4.2 inches at the bow and 3.8 inches at the after ends, which are joined by a transverse bulkhead, 3.9 inches thick. This belt extends 9.8 feet above water forward, 7.55 feet amidships, and 8.2 feet aft. The lower edge is 4.9 feet under water throughout. Above this belt the side armor forward, 2.2 inches thick, extends to the main deck and is continued from the stem to a point a little abaft the forward 6.48-inch guns. There are two protective decks. The lower one, with its flat at the level of the water-line, inclines downward at the sides to meet the lower edge of the main belt. The upper, or splinter deck, is flat and rests on the top of the belt. The lower protective deck is 1.77 inches thick. The upper one is 1.2 inches amidships, decreasing to 0.8 inch forward. The space between the protective decks is divided by four longitudinal bulkheads. The outer division,

between the outer bulkhead and the side, is the cofferdam and is divided into numerous compartments. Inside this is a wing passage for ammunition, etc. The central section is also subdivided. The smokepipe bases, ammunition hoists, etc., as they pass through it are protected by armor surrounding each. The 7.6-inch turrets and their bases are 7.9 inches thick; the turrets of the 6.48-inch guns, 4.72 inches; casemates for the after 6.48-inch guns are closed on the after side by a transverse bulkhead 4.72 inches thick; the casemates for the forward guns have a similar bulkhead on the forward side; the fronts of all the casemates are 4.7 inches thick and a thick shield on the gun closes the port against entry of projectiles. The 3.9-inch guns have shields in two parts, one fixed and one turning with the gun. There are two conning-towers, the forward one 7.9 inches thick and the after one 6.3 inches.

Motive power.—Triple-screw, triple-expansion engines of 20,500 I. H. P. Twenty-eight Niclausse boilers: six each in the two end compartments and eight in each of the others. Total number of elements, 352, 18 tubes in each; total grate surface 118.4 square feet; total heating surface, 39,904.15 square feet; total weight, including fuel and water in boilers, 369 tons. The coal supply is 970 tons; in addition to which tanks are fitted to carry 80 tons of petroleum.

Dimensions.—Length, 452.6 feet; beam, 66.3 feet; draft, 24.8 feet; displacement at this draft, 10,014 tons.

PERTUISANE, ESCOPETTE: LAUNCH, DESCRIPTION.—These two torpedo-boat destroyers, of the Fauconneau type, were launched at the government yard, Rochefort; the Pertuisane on December 5, 1900, and the Escopette on December 20. Their armament consists of two torpedo tubes; one 2.56-inch gun forward; and six 3-pounders, three each side. The designed horsepower of the machinery is 5700, and the expected speed is 27 knots. The coal capacity is 38 tons. The dimensions are: Length, 183.7 feet; beam, 19.48 feet; extreme draft, 10 feet; displacement, 303 tons. Complement, 4 officers and 44 men.

AUDACIEUX: TRIAL SPEED, DESCRIPTION.—The full power trial of this "armored" torpedo boat took place early in February. The speed obtained was 26.2 knots, 0.2 of a knot above the requirement of the contract. The Audacieux, and a sister boat, the Trombe, were built at the yard of the Ateliers et Chantiers de la Loire, Nantes. The Trombe is undergoing repairs due to an accident while having preliminary trials.

The armament of these boats consists of three torpedo tubes and two 3-pounders. An electric searchlight of 15.7 inches diameter is carried. The two compartments which contain the boilers and engines are covered on the sides and bulkheads with nickel-steel plates 0.95-inch thick. The deck over the boilers, engines, servo-motor, etc., is also armored—0.95-inch on the vertical and sloping parts and 0.35-inch on the horizontal parts. The machinery is designed to develop 4200 I. H. P. and give a speed of 26 knots. The coal capacity is 18 tons. The dimensions are: length, 177.6 feet; beam, 16.9 feet; extreme draft, 6.2 feet; displacement, 185 tons.

FRANÇAIS: LAUNCH, PARTIAL DESCRIPTION.—The submarine boat Français was launched at Cherbourg arsenal on January 25. She is a sister to the Algérien and was designed by M. Romazotti. These boats are of the Morse type with certain changes and improvements which have slightly increased the displacement. The hull is of steel, driven when submerged by electricity. The complement is one officer and eight men.

The trials of the boat are now in progress. The anticipated speed when running on the surface is 13 knots; and when submerged it is hoped that it will reach 8 knots. The radius of action is about 200 miles. The dimensions are: Length, 118.1 feet; beam and outside depth of hull, 9.18 feet; displacement submerged, 146 tons.

MORSE AND NARVAL: TRIALS.—The trials of French submarine boats have so far resulted in the victory of the Morse, which is of the true submarine type, over the submergible Narval. The Morse is similar in general features to the Holland but has only 2.5 tons buoyancy when at the surface, so that only a very small part of her 141 tons of hull is above water. Being driven by petroleum motors at all times (so stated by French papers), there is no change of motive power for submerging and she is able to accomplish it in two minutes after opening the valves to the tanks. She has then a slight negative buoyancy which is overcome by means of fins, or "ailettes" on each side. Should the pumps fail, she can at once be brought to the surface by detaching the lead ballast on the keel. The Narval is very different. She has wall sides and a flat deck and, when steaming on the surface, is like a low torpedo boat. To submerge her the motive power has to be changed, the smokepipe drawn in, and sufficient time must be allowed for the unused steam to cool down (so the reports say, but I doubt if steam is used), and a much larger quantity of water has to be admitted to the tanks than is the case with the Morse. At present the operation of submerging takes fifteen minutes and this is better than was done at the first trials. The new boats of this type are expected to submerge themselves in a little more than half this time. The Narval was to have been fitted with petroleum engines, but all the late reports say she is delayed in sinking by having to wait for the unused steam to cool down; if this is so, the plans must have been changed. When submerged she is propelled by storage batteries which she charges herself when running at the surface. In the trials recently made at Cherbourg the Morse submerged much quicker, steered as well or better, preserved her depth with greater steadiness, and fired her torpedoes with greater ease and accuracy. The Narval is, however, thought to be capable of much improvement and has points of superiority which render it desirable to develop the type as far as possible.

DÉVASTATION: RECONSTRUCTION.—The Dévastation, rebuilding at the Brest arsenal, is well advanced towards completion. Her upper works were nearly all removed, partly to effect changes, partly to get in her new Belleville boilers. A cofferdam is being fitted on the lower deck and some of the old iron armor has been replaced by plates of less weight but equal resisting force. Part of the superstructure has been suppressed. The 12.6-inch and 9.4-inch guns have been removed and will be replaced by six 10.8-inch. The changes will lighten the ship by about 200 tons and raise the upper edge of her belt about 4 inches higher out of water.

NEPTUNE, DUPERRÉ: RECONSTRUCTION.—These vessels will shortly be taken in hand at Brest for reconstruction. The estimated cost is $300,000 each. The superstructure of the Neptune will be reduced; also the masts. Belleville boilers will replace her present cylindrical ones; and the engines will be put in thorough repair and adapted to the new boiler pressure. The Duperré will also receive new boilers and her hull and engines will be repaired. The midship 13.4-inch. gun and fittings will be removed and replaced by four 6.48 guns in an armored casemate.

REQUIN: RECONSTRUCTION.—This old coast-defense ship has been in hand for a long time and the work is proceeding slowly, but she will probably be finished this year. The belt armor was very thick—19.5 inches, and it has been reduced in thickness in parts and otherwise lightened. The 16.5-inch guns have been removed and one 10.8-inch gun of later type placed in a closed turret, 9 inches thick, over each barbette. The engines have been thoroughly repaired and Niclausse boilers substituted for the old cylindrical ones. The total reduction in weights is about 600 tons, and it is expected that this will bring the upper edge of the belt (which was totally submerged at full load) well above water.

FURIEUX: RECONSTRUCTION.—The work on the Furieux, which is a much smaller ship, will be similar to that done on the Requin. The two 13.4-inch guns in barbettes will be replaced by two 9.4-inch guns of recent model in pairs in closed turrets. The engines will be repaired and Belleville boilers will replace the old cylindrical ones. The total lightening of the ship is estimated at 246 tons.

MARCEAU: RECONSTRUCTION.—The rebuilding of the Marceau is under way at the Toulon arsenal. The changes to be effected are similar to those to be made in the Neptune, already described.

GERMANY.

BUDGET FOR 1901.—The German naval budget for 1901 is fixed at 79,831,422 marks ($18,999,878.44—1 mark = $0.238) for the ordinary expenditure and 120,986,150 marks ($28,794,703.70) for the extraordinary; the total contemplated expenditure being 200,817,572 marks ($47,794,582.14). The extraordinary vote, following out the provisions of the German Naval Law, contains the following allotments for new construction and the rebuilding of existing ships: 1. For the battleships H and I, 6,000,000 marks. 2. For an armored cruiser to replace the Konig Wilhelm, 2,400,000 marks. 3. For three small cruisers, G, H and I (one of which is additional, the others in place of old ships), 3,900,000 marks. 4. For the construction of a division of torpedo boats, 2,400,000 marks. 5. For lengthening and rebuilding vessels of the Siegfried class, 4,500,000 marks; also 500,000 marks for their armament and equipment. The sum of 74,800,000 marks is allotted for vessels now under construction; and 1,000,000 marks to commence work on a third entrance to the port of Wilhelmshaven, the total cost of which is estimated at 30,000,000 marks. The German Navy League has placed at the emperor's disposal a certain amount from the reserve funds to be spent on work abroad. When the assent of the Reichstag is obtained, a river gunboat for service in China and the East will be ordered.

VESSELS BUILDING.

Name.	Displacement (tons).	Where Building.	Remarks; when compl.
Battleships.			
Wittelsbach	12,000	Govt. Yd., Wilhelmshavn.	Launched July 3, 1900.
D	12,000	Schichau, Dantzic.	Will be launched 1901.
E	12,000	Germania Yard, Kiel.	"
F	12,000	Vulcan Yard, Stettin.	"
G	12,000	Govt. Yd., Wilhelmshavn.	Keel laid Dec. 1, 1900.
H	?	?	Not yet ordered.
I	?	?	"
Kaiser Wilhelm der Grosse.	11,130	Germania Yard, Kiel.	Lchd. 1899, compl. 1901.
Kaiser Karl der Grosse	11,130	Blohm & Voss, Hamburg.	Delayed by strike.
Kaiser Barbarossa	11,130	Schichau, Dantzic.	Lchd. April 21, 1900.

VESSELS BUILDING—*Continued.*

Name.	Displacement (tons).	Where Building.	Remarks; when compl.
Armored Cruisers.			
Ersatz Konig Wilhelm	?	?	Not yet ordered.
Prinz Heinrich	8,868	Government Yard, Kiel.	Launched March, 1900.
B	8,868	"	To be launched 1901.
Protected Cruisers.			
Nymphe	2,645	Germania Yard, Kiel.	Practically complete.
Niobe	2,645	Weser Yard, Bremen.	"
Thetis	2,645	Govt. Yard, Dantzic.	Fitting out.
Ariadne	2,645	Weser Yard, Bremen.	"
Amazone	2.645	Germania Yard, Kiel.	Launched Oct. 6, 1900.
E	2,645	Govt. Yard, Dantzic.	Building.
G	?	?	Not yet ordered.
H	?	?	"
I	?	?	"
Gunboat.			
A	899	Govt. Yard, Dantzic.	Building.
Torpedo Boat Destroyers.			
S_{96} to S_{97} (8 boats)	350	Schichau, Dantzic.	Bldg.; mostly compl.
S_{98} to S_{105} (8 boats)	350	"	Nearly all launched.
S_{106} to S_{113} (8 boats)	350	"	New program.

NEW BATTLESHIPS H AND I.—These vessels will not be sister ships to the Wittelsbach but of a new and larger type. The particulars are not yet published but the rumors are that they will carry Krupp's new 28-centimeter (11.02-inch) rapid-firing gun instead of the 24-centimeter piece; and also more than eighteen 6-inch, or else a dozen or more 8-inch. It is believed that no change will be made in the amount of protection or speed; but of course the displacement will be much increased.

BATTLESHIP G: KEEL LAID, DESCRIPTION.—The keel of this ship was laid at the government yard, Wilhelmshaven, December 1, 1900. She is a sister ship to the Wittelsbach and D, E, and F; and, if rumor is to be believed, is the last of this class to be built. Unlike the Kaiser Wilhelm II class, the superstructure is not carried to the bow so that the forecastle is at the level of the main deck. The superstructure is double-decked, making the ship very much higher amidships than the vessels of the Kaiser class. There are two military masts with tops rather low down and with searchlight platforms at the lower masthead. The smoke-pipes are large and two in number. The bow is of pronounced ram shape but does not recurve at the upper end of the stem like most recent German ships. The principal details are:

Armament.—Four 9.4-inch guns in balanced turrets over barbette towers forward and aft on the main deck. Eighteen 5.9-inch guns: eight on the gun deck amidships, four in a long armored casemate on each side, the forward guns firing directly ahead and the after guns directly astern; two in armored casemates on the main deck forward underneath the muzzles of the forward 9.4-inch guns; two in armored casemates, one each side on the gun deck just forward of the after 9.4-inch barbette tower, with fire directly astern; four in four small turrets on the main deck directly over the long central casemate, forward guns firing directly ahead and after guns directly astern; one each side on main deck in forward corners of superstructure, firing directly ahead. Sixteen 3.46-inch guns: four in forward end of upper superstructure, firing directly ahead; four in after end of upper superstructure with stern fire; two each

side in the upper superstructure, in an angle jutting out each side amidships, forward pair firing directly ahead and the after pair directly astern; and four on the forward end of upper superstructure, the forward pair of which is probably able to fire directly ahead. Twelve 1-pounders. Eight machine guns. Five submerged torpedo tubes: one in the keel about 25 feet from the ram, one each side abreast the forward 9.4-inch turret, and one each side beneath the center of the long casemate. The axes of the forward 9.4-inch guns are 30 feet above water and of the after pair about 21.5 feet.

Protection.—Complete water-line belt, 9.45 inches thick amidships, tapering to 8 inches abreast ends of superstructure, thence 5.9 inches to bow and stern. The turrets of the 9.45-inch guns are 10.6 inches thick and they rest on barbette towers about 9 feet high. From the bases of the barbettes a 10-inch loading tube extends to the protective deck. The turrets and casemates for the 5.9-inch guns are all 5.6 inches thick. The protective deck is curved, rising from the lower edge of the armor belt; for about one-third the length amidships the crown is about on a level with the upper edge of the belt, thence dropping gradually to the level of the lower edges of the belt at bow and stern. The turrets and isolated casemates of the 5.9-inch guns have armored loading tubes extending down to the protective deck, but the armor of the large midship casemate is carried down to the belt; while at its ends armored bulkheads extend across the ship from side to side and, like the faces of the casemates, the bulkheads are 5.6 inches.

Motive power.—Triple-screw engines designed to develop 15,000 I. H. P. and give a speed of 19 knots. Thorneycroft-Schultz water-tube boilers. The coal supply at load draft is 600 tons; total capacity, 1200 tons.

Dimensions.—Length between perpendiculars, 393.6 feet; beam, 68.2 feet; draft, 25 feet; displacement, 12,000 tons.

MEDUSA: LAUNCH.—This small protected cruiser of 2645 tons was launched at the yard of the Weser Company, Bremen, December 5, 1900. She is a sister ship to the Amazone, fully described in the PROCEEDINGS, No. 96, of December, 1900, page 703.

NIOBE, NYMPHE: TRIALS.—The *Marine Rundschau* gives some particulars of the trials of these cruisers, which are sister ships to the Medusa, except that the Niobe is sheathed and coppered. The Niobe's trials, which took place in July and August, 1900, are given in considerable detail. After preliminary runs to drill the engineer's force, the ship had five trials. One of 6 hours at full power; three of 24 hours, for coal consumption, at speeds of 11, 12 and 17 knots, and one of 72 hours at full speed with very moderate air-pressure in the fire-rooms. The particulars are as follows:

Duration, hours	6	24	24	24	72
Draft, mean, feet	15.66	15.73	15.68	15.81	15.81
I. H. P., main engines.....8000		913	1204	3586	4852
Air pressure, inches	1.3	n. d.	n. d.	*	0.4
Revolutions	166.6	79.6	87.25	127.25	140.3
Speed, knots	21.6	11	12	17	19.45
Coal, per sq. ft. grate, lbs.		17.0	19	17.4	25.1
Coal, per I. H. P., lbs.....		2.41	2.13	1.86	2.01

* Blowers running but fire-rooms open.

The measured mile trials of the Niobe at different speeds gave the following results:

Speed.	I. H. P.	Revolutions.
21.594 knots	8511	166.4
17.048 knots	3505	126.73
11.979 knots	1183	87.09
11.189 knots	945	81.03

The results of the Nymphe's full power trial were: I. H. P., a little over 9000; revolutions, 158; speed 22.3 knots.

TORPEDO BOAT DESTROYERS S90 TO S113.—These boats are of about 350 tons displacement. The first division, S90 to S97, are all, or nearly all, completed. Of the division S98 to S105, nearly all will be launched by the time these notes are published. The division S106 to S113 are to be commenced this year. The second division, S98 to S105, are of the following dimensions: Length, 223 feet; beam, 21.3 feet; draft, 9.8 feet; displacement, 350 tons. The machinery is expected to develop 5400 I. H. P. with ease and give a speed of 26 knots on a long course. The boats of the other divisions are believed to be practically the same as these in design and dimensions.

HAGEN: RECONSTRUCTION, TRIAL.—The vessels of this class have proved a disappointment. They were designed as coast defenders and given a small coal capacity which has been found to be altogether too small. Furthermore they fell short of the designed speed of 16 knots by more than a knot and were, besides, deficient in stability. Radical measures to cure these ills were regarded as necessary and it was decided to experiment with the Hagen. She was cut in two and lengthened seven frame spaces (27.55 feet), increasing the length from 239.5 to 267 feet and improving her stability materially. At the same time Thorneycroft water-tube boilers, fitted for burning oil in conjunction with coal, were substituted for the old locomotive boilers. The single pole mast was removed and replaced by a military mast carrying a top with 37-millimeter machine guns. Two 3.4-inch guns were added to the battery; a flying bridge added between the forward and after bridges; the conning-tower more than doubled in thickness; and another smokepipe added, as the new boilers required two. The following is a comparison of the principal details before and after reconstruction:

	Before.	After.
Length between perpendiculars, feet	239.5	267
Breadth, extreme	48.97	49.07
Draft, mean, feet	17.46	17.46
Displacement, metric tons	3500	4114
Battery, 24-cm., 35 calibers	3	3
8.8-cm., 30 calibers	8	10
37-mm. machine guns	0	6
8-mm. machine guns	6	4
Torpedo tubes, 35-cm., bow, submerged	1	1 armored
35-cm., broadside, above water.	2	0
45-cm., broadside, submerged..	0	2
35-cm., stern, above water	1	0
45-cm., stern, above water	0	1
Conning-tower, thickness, inches	3.15	7.08
Masts	signal mast	military mast

	Before.	After.
I. H. P.	4545	5178
Boilers	4 locomotive	8 Thorneycroft.
Smokepipes	1	2
Coal supply, normal, metric tons	220	350
Coal capacity, metric tons	220	580
Complement	276	297
Turning circle at 12 knots, yards	400	430
Capacity of oil tanks, tons	0	1.7
Speed on trial, knots	14.85	15.1

The reconstruction of the Hagen is regarded as successful in all respects, and the other ships of the class will be similarly altered as soon as practicable.

PRINZESS WILHELM: RECONSTRUCTION.—This second-class protected cruiser of 4400 tons, launched in 1887, is to be modernized at Wilhelmshaven. The engines will be thoroughly repaired, new boilers supplied, a new protective deck fitted, and all woodwork removed and replaced by steel or non-inflammable material.

GREAT BRITAIN.

NAVAL ESTIMATES FOR 1901-1902.—The naval estimates for 1901-02 have been presented to parliament, but so far only telegraphic reports have reached this country. As full accounts will not be received until after this number of the PROCEEDINGS goes to press, the details of the new estimates will be given in No. 98. The total amount of the new estimates is £30,875,500 (£1 = $4.8665), an increase of over £2,000,000, chiefly for shipbuilding. The sum allotted to new construction is £9,003,256, of which £8,465,406 will be devoted to work in hand and the remainder for commencing new vessels. The vote for personnel includes provision for an increase of 9745 officers and men.

NEW PROGRAM.—The new program provides for three battleships, six armored cruisers, two third-class cruisers, ten torpedo-boat destroyers, five torpedo boats, two sloops of war, and five submarine boats. On some of these vessels work was begun in 1900. All the ships will be under construction before the end of this year. Under the heading of submarine boats, the First Lord says:

"Five of the type invented by Holland have been ordered, the first of which should be delivered next autumn. What the future value of these boats may be in naval warfare can only be a matter of conjecture. Experiments with these boats will assist the Admiralty in assessing their true value. The question of their employment must be studied in all its developments, and their mechanism carefully watched in this country."

SUPPLEMENTARY ESTIMATES FOR 1900-1901.—A supplementary estimate for naval services for the current financial year was issued this week. The additional number of men to be voted is 600, and the additional amount required £1,250,000. The votes affected by this estimate are: Vote 1. Wages, etc., of officers, etc., £500. Vote 2. Victualling and clothing, £84,000. Vote 8. Shipbuilding, etc., £935,500. Vote 11. Miscellaneous effective services, £230,000. Under the last-named heading are included the following estimates, for which no provision had previously been made: Hire of steam-vessels for communications in China, £18,500; expenditure in connection with the seizure and detention of vessels in

South African waters, £30,000; subsidy for use of South Australian gunboat Protector in Chinese waters, £2500; hire of distilling vessels during manœuvres, £9000; hire, etc., of steamship Ophir in connection with the visit of the Duke and Duchess of Cornwall and York to Australia, etc., £43,000. The effect of the supplementary estimate on the estimated expenditure for shipbuilding is to increase the sums allocated for new construction on dockyard-built ships by £29,160 and on contract-built ships by £207,000.—*Army and Navy Gazette*, London.

INSTRUCTION FOR MIDSHIPMEN AND CADETS IN ENGINE AND FIRE ROOMS.—Orders have been issued that midshipmen and naval cadets are to be allowed to take advantage of ships being under way to keep watch in the engine and fire rooms of British ships, with a view to their steam instruction being of a more practical character than it has been in the past. With this end in view an engineer officer has now to assist the instructing lieutenant in the first instruction in seamanship, as well as the carpenter, who has hitherto given more time to the explanation of the lighter problems of ship construction.—*The Engineer*, London.

NAVAL RESERVE ACT OF 1900.—This bill, passed just before the general election, empowers the Admiralty to raise a new division of the Royal Naval Reserve. This division is to be known as the Royal Fleet Reserve and regulations for its administration have been issued. It is to be composed of three classes: (*a*) Men in receipt of a long service pension for service as seamen, stokers, or marines; (*b*) Men who have served as seamen, stokers, or marines, but are not in receipt of a pension for such service; (*c*) Men employed as artisans or otherwise in any of the naval or civil establishments under the Admiralty, subject to a condition of service in the reserve. The first and third classes are not limited as to numbers, but the second class is limited to 15,000 men. Previously, reserves for the navy have been raised outside the service itself, but the present scheme is to raise a reserve from the navy and marines. So far as the seamen are concerned, the present scheme is an amplification of the present coastguard system, but the marine reserve is an entirely new body, and the arrangement to provide a reserve from the artisans who are trained in the dockyards is also new. In the course of time all seamen pensioners will become absorbed in the Royal Fleet Reserve, as, under the new rule, every man and boy joining the service after a certain date will be obliged to join this reserve as a condition of receiving a pension. Class B of this new reserve introduces a modified form of short service in the navy, and will probably rouse hostile criticism. Men who have completed a twelve years' engagement will be eligible, but service is entirely optional. The period of engagement is five years, but arrangements for further periods of the same length up to 55 years of age can be made.

Candidates for the new reserve must apply to the Commanders, R. N., at each of the three naval depots, and the staff officers, R. M., at Eastney, Chatham, Gosport and Plymouth, who are nominated as "Registrars," and are to be held responsible for the correct registration of the men attached to their corps, and for duties generally in connection with enrolment, re-enrolment, and service. The Admiralty will regulate the numbers to be entered annually in Class B, but apparently further instructions will be issued in connection with the entry of those men who have less than 12 years' service. In the case of others they may make application to their commanding officer for enrolment six months before

they complete their continuous service engagement, and if accepted they will be acquainted at once, and be entered in the Royal Fleet Reserve from the date of discharge from active service. Every man enrolled is to undergo a week's drill every year or a fortnight's drill every second year, at his own option, until attaining the age of fifty. This drill is to be carried out as a rule at the port of enrolment where special classes of instruction will be formed; for the seamen at the gunnery, torpedo or signal schools; for the stokers at the dockyard reserves and for the marines at headquarters. Full instructions are given on the subject of this drill, and the registrars are notified to be careful that all fleet reserve men fully understand the rules in this connection. As the payment of retaining fees and pensions depends upon putting in this drill within the prescribed period, this is important. In Classes B and C men will be liable up to the ages of 55 and 50 respectively to serve in the navy for three years when called out in emergency, but it may be extended by proclamation to five years. A man may claim his final discharge after five years' service from the date of being called out. Service in this reserve is to be naturally followed by an increase of pension or by the grant of pension to those not already receiving one.—*Marine Engineer*, London.

VESSELS BUILDING.

Name.	Displacement (tons).	Where building.	Remarks.
Battleships.			
Queen	15,000	Government Yard, Devonport.	Not yet commenced.
Prince of Wales	15,000	" Chatham.	"
Duncan	14,000	Thames Co., Blackwall.	To be lchd. March 21.
Cornwallis	14,000	" "	To be launched soon.
Exmouth	14,000	Laird, Birkenhead.	Not yet launched.
Russell	14,000	Palmer Co., Jarrow.	Launched Feb. 19, '01.
Albemarle	14,000	Government Yard, Chatham.	Launched Mar. 5, 1901.
Montagu	14,000	" Devonport.	"
London	15,000	" Portsmouth.	Compl. in autumn, '01.
Bulwark	15,000	" Devonport.	Launched June, 1901.
Venerable	15,000	" Chatham.	Lchd.; trials in 1901.
Formidable	15,000	" Portsmouth.	Compl. this summer.
Irresistible	15,000	" Chatham.	Nearly ready for trial.
Implacable	15,000	" Devonport.	Trials in progress.
Vengeance	12,950	Vickers, Barrow.	Launched.
Albion	12,950	Thames Co., Blackwall.	Trials in progress.
Glory	12,950	Laird, Birkenhead.	Has had trials.
Armored Cruisers.			
Drake	14,100	Government Yard, Pembroke.	Launched Mar. 5, 1901.
King Alfred	14,100	Vickers, Barrow.	Not yet launched.
Leviathan	14,100	J. Brown & Co., Clydebank.	"
Good Hope	14,100	Fairfield Co., Govan.	Launched Feb. 21, 1901.
Essex	9,800	Government Yard, Pembroke.	Not yet launched.
Kent	9,800	" Portsmouth.	Launched, Mar. 6, 1901.
Monmouth	9,800	London & Glasgow Co., Glasgow.	Not yet launched.
Bedford	9,800	Fairfield Co., Govan.	To be launched 1901.
Cornwall	9,800	Government Yard, Pembroke.	Ordered Nov. 1900.
Suffolk	9,800	" Portsmouth.	"
Berwick	9,800	Beardmore (ex-Napier), Glasgow.	"
Cumberland	9,800	London & Glasgow Co., Glasgow.	"
Lancaster	9,800	Armstrong, Elswick.	"
Donegal	9,800	Fairfield, Govan.	"

VESSELS BUILDING—*Continued.*

Name.	Displacement (tons).	Where building.	Remarks.
Cressy	12,000	Fairfield, Govan.	Has had trials.
Aboukir	12,000	"	Launched; trials soon.
Hague	12,000	Vickers, Barrow.	"
Sutlej	12,000	J. Brown & Co., Clydebank.	"
Euryalus	12,000	Vickers, Barrow.	Not yet launched.
Bacchante	12,000	J. Brown & Co., Clydebank.	Launched Feb. 21, '01.
Protected Cruisers.			
Challenger	5,880	Government Yard, Chatham.	Ordered Nov., 1900.
Encounter	5,880	" Devonport.	"
Spartiate	11,000	" Pembroke.	Trials in progress.
Pandora	2,200	" Portsmouth.	"
Gunboats.			
Odin	1,070	Government Yard, Sheerness.	Ordered Nov., 1900.
Merlin	1,070	" "	"
Espiègle	1,075	" "	Building.
Fantome	1,075	" "	"
Mutine	980	Laird, Birkenhead.	Trials finished.
Rinaldo	980	"	Nearly ready for trial.
Torpedo-Boat Destroyers.			
Arab	320	J. Brown & Co., Clydebank.	Launched.
Falcon	355	Fairfield Co., Govan.	Had trials.
Greyhound	316	Hawthorn, L. & Co., Hebburn.	Launched Oct., 6.
Kangaroo	...	Palmer Co., Jarrow.	Trials in progress.
Lively	355	Laird, Birkenhead.	Launched.
Myrmidon	317	Palmer Co., Jarrow.	"
Ostrich	355	Fairfield Co., Govan.	Had trials.
Peterel	317	Palmer Co., Jarrow.	"
Racehorse	316	Hawthorn, Hebburn.	Launched Nov. 8.
Roebuck	316	"	Launched Jan. 4, 1901.
Sprightly	355	Laird, Birkenhead.	Launched.
Success	350	Doxford, Sunderland.	
Syren	317	Palmer, Jarrow.	Launched Dec. 20.
Torpedo Boats.			
Two boats	175	Thorneycroft, Chiswick.	Ordered.
No. 98	178	"	Launched Jan. 22, 1901.
No. 99	178	"	Launched Mar. 6, 1901.
Two other boats	178	"	Building.

CHALLENGER, ENCOUNTER: KEELS LAID.—The keels of these two new protected cruisers are to be laid this month (March), that of the former at Devonport and of the latter at Chatham. The displacement will be 5880 tons; I. H. P. of the machinery, 12,500; speed, 21 knots. Both vessels will have water-tube boilers; those of the Encounter, 18 in number, arranged in groups of six in separate fire rooms, will be of the Belleville type.

MERLIN, ODIN: LAID DOWN.—These gunboats of 1070 tons have been laid down at the government yard. Sheerness. The displacement will be 1070 tons; horsepower of machinery, 1400; speed, 13.25 knots. The hulls will be of steel sheathed with wood and coppered. Both will have water-tube boilers, those of the Merlin to be of the Niclausse type.

KHAKI, NUBIAN, DISTILLER, REPAIR SHIP: PURCHASED.—The London *Engineer* says that it is given to understand that the Admiralty has recently purchased two large steamers to serve as colliers for the navy;

H. M. S. RUSSELL, BUILT AND ENGINED BY PALMER'S SHIPBUILDING AND IRON COMPANY, LIMITED, JARROW-ON-TYNE.
From the Marine Engineer.

one of which, named the Khaki, will be attached to the Channel squadron, while the other, the Nubian, goes to the Cape of Good Hope station for the present. At the same time a large steamer was purchased, and will be equipped with machine tools, to act as a repairing ship; while a fourth vessel, to be known as the Distiller, will be fitted with an extensive plant for distilling water for the vessels of the fleet. These vessels will only be able to steam at what is known as the cruising speed of the fleets.

ALBEMARLE, RUSSELL, MONTAGU: LAUNCH, DESCRIPTION.—These first-class battleships were launched as follows: the Albemarle at the government yard, Chatham, March 5; the Montagu at the government yard, Devonport, March 5; the Russell at the works of the Palmer Shipbuilding Company, Jarrow-on-Tyne, February 19. The vessels of this class, six in number, are believed to be practically identical in design. The hull is of steel without sheathing and is divided into 320 water-tight compartments. The double-bottom extends about four-fifths the length amidships. There are two smokepipes on the fore and aft line, the after one much the larger; and two masts each carrying one military top and a searchlight platform, the latter at the lower masthead. Eighteen boats are carried, of which two are 56-foot steamers. They are handled by a 36-ton derrick on the mainmast and two 10-ton derricks on the foremast. The general plan of the upper works is similar to that of all recent British battleships. The ship has two conning-towers and can be fought from either. Six 25,000 c. p. searchlights are carried, and the ship is lighted by 900 incandescent lamps. The principal details are:

Armament.—Four 12-inch, 40-caliber, wirewound guns in pairs in turrets over barbette towers forward and aft, with arc of train of 120 degrees on each side of the keel. Twelve 6-inch guns: four each side on the gun-deck, in armored casemates, the forward and after pieces firing from directly ahead or astern to 30 degrees abaft or forward the beam; four on the main deck directly over the forward and after guns on the deck below, in similar casemates, and having the same arc of fire. Twelve 12-pounders: one each side on the gun deck well forward, and one on each side on the gun deck aft; three each side in the waist on the main deck between the 6-inch casemates; two, which are also boat and field guns, on the forward bridge deck. Eight Maxim machine guns. Six 3-pounders—three in each top. Four submerged torpedo tubes, two forward, two aft.

Protection.—The main belt, about fourteen feet wide, from 5 feet below water to the gun deck, is 7 inches thick and extends for a length of 286 feet from abreast the after barbette to within about 15 feet of the stem. Its after ends are joined to the after barbette by a curved bulkhead. Forward, the belt is continued to the bow by 2-inch armor laid over ordinary plating. This 2-inch armor extends down to the keel for ten or twelve feet abaft the ram but only rises to the berth deck. The middle deck is flat along the center line between the barbettes and is about 2.5 feet below water. This part is 1 inch thick. The sides drop (at an angle of about 40 degrees amidships) to meet the lower edge of the belt throughout its length. Beyond the barbette towers the central part gradually descends until it also is at the level of the lower edge of the belt. The sloping parts of this deck are 2 inches thick amidships, reduced to 1 inch at the ends. The gun deck, resting on top of the belt, is 1 inch thick. The lower deck, which acts as a splinter deck, is 1 inch thick amidships

and forward and 2 inches thick aft to afford extra protection to the steering-gear. The barbette towers for the 12-inch turrets are 11 inches thick except behind the belt armor where the thickness is reduced to 6 inches. The turrets are 8 to 10 inches. The forward conning-tower is 12 inches thick and of face-hardened armor, while the after one is 5 inches and of nickel steel.

Motive power.—Twin-screw, 4 cylinder, triple-expansion engines, with cylinders 33.5, 54.5, 63, and 63, inches in diameter and of 48 inches stroke. There are 24 Belleville boilers in three firerooms. Heating surface of boilers, 45,000 square feet; pressure of steam at boilers, 300 pounds; at engines, 250 pounds. Estimated total I. H. P. of machinery 18,000, designed to give a speed of 19 knots. The coal supply at load draft is 900 tons; total capacity, about 2000 tons; total number of coal bunkers, 52.

Dimensions.—Length between perpendiculars, 405 feet; beam, 75.5 feet; draft, 26.5 feet; displacement at this draft, 14,000 tons.

DRAKE, GOOD HOPE: LAUNCH.—These armored cruisers have been launched; the Drake at the government yard, Devonport, on March 5, and the Good Hope at the yard of the Fairfield Company, Govan, on February 21. A full description of these vessels will be given in the next number of the PROCEEDINGS.

BACCHANTE: LAUNCH, DESCRIPTION.—This armored cruiser of the Cressy class was launched at the works of Sir J. Brown & Company, Limited, Clydebank, on February 21. The others of the class are the Cressy, Aboukir, Hague, Sutlej, and Euryalus. All except the last-named are now launched. The hull is of steel, sheathed and coppered. There are four smokepipes on the fore and aft line, and two pole masts carrying searchlight platforms at the lower masthead. The freeboard is high for the greater part of the length as the superstructure extends from just forward the after turret to the stem. The topsides are cut away forward and aft to enable the forward and after 6-inch guns to fire parallel with the keel. For handling the boats there are two derricks on the foremast and one large one on the main. The principal details are:

Armament.—Two 9.2-inch guns in gun-houses over barbette towers, one forward, one aft. Twelve 6-inch guns: four each side on the gun deck in separate armored casemates, the forward and after pairs firing ahead and astern respectively; four in separate casemates on the main deck over the forward and after guns of the deck below and with similar arcs of fire. Twelve 12-pounders: four each side in the superstructure between the 6-inch guns; one each side in the superstructure well forward; and one each side on the gun deck well aft. Two 12-pounder boat and field guns are mounted on the after bridge deck. Three 3-pounders and eight machine guns on the decks and bridges. Two submerged torpedo tubes.

Protection.—The total weight of armor is about 1200 tons. The main belt, 6 inches thick and 11.5 feet deep (descending 5 feet below water and rising to the gun deck, 6.5 feet above it) extends for a length of about 230 feet amidships, terminating at 120 feet from the bow and 90 feet from the stern in 5-inch diagonal bulkheads extending in to the barbette towers. Forward of the belt 2-inch armor of the same depth extends to the stem, deepening slightly as it follows the edge of the protective deck until it reaches the point of the ram. The protective deck extends from stem to stern and it is 1.5 inches thick on the flat and 3 inches on the slopes. The flat amidships is about at the water-line, the sides sloping down to meet the lower edge of the belt. The barbette towers, fronts and sides

of gun-houses, and fronts of casemates, are all 6 inches thick. The inner walls of the casemates are 2 inches and the conning-tower 12 inches.

Motive power.—The engines are twin-screw, 4-cylinder, triple-expansion, with cylinders 36, 59, 68, and 68 inches in diameter and 48 inches stroke; and which, at 120 revolutions, are expected to develop 21,000 I. H. P. and give a speed of 21 knots. The boilers are 30 in number, of the Belleville type, arranged in four compartments, six in each forward one, and eight in each after one. The working steam pressure is 300 pounds at the boilers, reduced to 250 pounds at the engines. The coal supply at load draft is 800 tons; total capacity, 1600 tons.

Dimensions.—Length between perpendiculars, 440 feet; beam, 69.5 feet; mean draft, 26.25 feet; displacement at this draft, 12,000 tons.

KENT: LAUNCH.—The armored cruiser Kent, 9800 tons, was launched at the government yard, Portsmouth, March 6, 1901. The vessels of this class were fully described in PROCEEDINGS No. 96, page 696.

ESPIÈGLE: LAUNCH, DESCRIPTION.—This gunboat, a sister to the Fantome, still on the stocks at the same yard, was launched at the government yard, Sheerness, December 7, 1900. The hull is of steel, sheathed and coppered. She has one smokepipe and a barquentine rig. The principal details are:

Armament.—Six 4-inch guns; four 3-pounders; two .45-cal. Maxim machine guns.

Motive power.—Twin-screw, triple-expansion engines, and Belleville boilers. Designed I. H. P., 1400; corresponding estimated speed, 13.25 knots. Coal capacity, 160 tons.

Dimensions.—Length between perpendiculars, 185 feet; beam, 33 feet; draft, 11.5 feet; displacement at this draft, 1075 tons.

CRESSY: TRIALS.—This armored cruiser is a sister ship to the Bacchante, already fully described. She had trials as follows, which were completed in December:

1. Thirty hours at one-fifth power on November 23 (draft forward, 25.5 feet; aft, 26.75 feet) gave: I. H. P., 4731; revolutions, 74; speed, 13.89 knots. Head wind; sea moderate to rough.

2. Thirty hours at four-fifths power on November 29: I. H. P., starboard, 8141; port, 8129; total, 16,270; revolutions, starboard and port, 114.6; speed, 20.5 knots. Wind light and sea smooth.

3. Eight hours at full power on December 5: I. H. P., starboard, 10,473; port, 10,767; total, 21,200; average revolutions, 122; speed, 20.79 knots. Sea rough.

SEA TRIAL OF MEDITERRANEAN SQUADRON.—Some of the principal ships of this squadron took part in a trial or race, at four-fifths power, from a point six miles east of Gibraltar to another six miles north of Cape Figari, Sardinia, and 788 miles away. The results were:

Name of Ship.	Normal displacement.	Coal short on leaving Gibraltar.	Coal expended on trial.	Time occupied on trial.	Average speed per hour.
	tons.	tons.	tons.	h. m.	knots.
Ocean	12,950	110	518	46 54	16.8
Isis	5,600	65	264	47 12	16.7
Dido	5,600	30	303	48 30	16.25
Renown	12,350	441	354.3	49 6	16.03
Venus	5,600	25	329.75	49 16	15.99
Caesar	14,900	124.6	406.3	52 30	15.00
Victorious	14,900	809.35	455.3	52 36	14.98
Royal Sovereign	14,150	89	385	54 18	14.51
Royal Oak	14,150	95	509.5	55 10	14.3
Illustrious	14,900	116	469.9	55 20	14.25
Ramillies	14,150	98	337	55 22	14.22

SHEARWATER: FULL SPEED TRIAL.—This gunboat of 980 tons, a sister to the Mutine, Rinaldo, and others, completed her full speed trials satisfactorily. The results were: Steam at boilers, 226.8 pounds; steam at engines, 200.8 pounds; vacuum, 23.5 inches; revolutions, 194.2; I. H. P., h. p. cylinder, 430; intermediate cylinder, 461.3; low pressure cylinder, 541; total I. H. P., 1432.3; coal consumption reported as 1.57 pounds per I. H. P. per hour. Draft on trial, forward, 10 feet; aft, 13 feet.

MUTINE: TRIALS.—The trials of the gunboat Mutine, 980 tons, were completed in February. The results were:

1. Thirty hours at three-fourteenths power: Steam at boilers, 170.2 pounds; at engines, 168.4 pounds; vacuum, 27.15 inches; revolutions, 122.1; I. H. P., h. p. cylinder, 110.2; int. cyl., 84.1; l. p. cyl., 135.5; total, 329.8; speed, 8.1 knots; coal consumption, 1.87 pounds per I. H. P. per hour. Draft on trial, forward, 10.2 feet; aft, 13 feet.

2. Thirty hours at five-sevenths power: Steam at boilers, 198.7 pounds; at engines, 195.5 pounds; vacuum, 28.08 inches; revolutions, 181.3; I. H. P., h. p. cyl., 347.9; int. cyl., 291.9; l. p. cyl., 401.1; total, 1040.9 I. H. P.; speed, 12.2 knots; coal consumption per I. H. P. per hour, 1.72 pounds. Draft on trial, forward, 10.1 feet; aft, 12.9 feet.

3. Eight hours full power: Steam at boilers, 225.2 pounds; at engines, 215.6 pounds; air pressure, 0.17 inch; vacuum, 26.4 inches; revolutions, 206.5; mean pressure, h. p. cyl., 90.3; int. cyl., 31.1; l. p. cyl., 16.67; I. H. P., h. p. cyl., 483.9; int. cyl., 428.8; low, 577.9; total I. H. P., 1490.6; speed by patent log, 14.55 knots; speed on the measured mile, 13.74 knots; coal consumption, 1.63 pounds per I. H. P. per hour. The draft was practically the same as on preceding trials.

NEW TORPEDO BOATS ORDERED.—The two torpedo boats provided for in the budget of 1900-1901 have been ordered of Thorneycroft. The dimensions given by the *Journal of the Royal United Service Institution* are: Length, 160 feet; beam, 17 feet; mean draft, 5.75 feet; displacement, 175 tons. The horsepower of the engines is to be 2850; speed, 26 knots. Coal supply, 30 tons. Armament, three torpedo tubes and three 3-pounder guns.

GREYHOUND, RACEHORSE, ROEBUCK: LAUNCH, DESCRIPTION.—These torpedo-boat destroyers are building at the yard of Messrs. Hawthorn, Leslie & Co., Hebburn-on-Tyne. The Greyhound was launched on October 6; the Racehourse, November 8; and the Roebuck, January 4, 1901. They are alike in all respects and the dimensions are: Length, 210 feet; beam, 21 feet; depth, 12.5 feet; displacement, 316 tons. The armament will consist of one 12-pounder, five 6-pounders, and two deck torpedo tubes. The engines are designed to develop 6000 I. H. P. at 390 revolutions and give a speed of 30 knots. Four Yarrow boilers, in two separate compartments, supply steam at 250 pounds pressure.

SYREN: LAUNCH, DESCRIPTION.—The Syren is a sister to the Myrmidon and Peterel, already launched. These boats are all building at the yard of the Palmer Shipbuilding and Iron Company, Jarrow, where the Syren was launched December 20, 1900, and they are of the following dimensions: Length, 215 feet; beam, 20.75 feet; displacement, 317 tons. The armament consists of one 12-pounder, five 6-pounders, and two torpedo tubes on revolving platforms for firing on either side. Steam is supplied by four Reed boilers, and the guaranteed speed is 30 knots.

TORPEDO BOATS NO. 98 AND NO. 99: LAUNCH.—These boats are two of the four building by Thorneycroft for the British navy and were

launched at Chiswick on January 22 and March 6, respectively. The dimensions, according to the *Army and Navy Gazette*, are: Length, 155 feet; beam, 17 feet; draft aft, 8.4 feet; displacement (*Naval Annual*), 178 tons. The I. H. P. of the machinery is estimated at 2800 and the required speed is 25 knots. The armament will consist of three torpedo tubes and three 3-pounders.

LEE: TRIAL, DIMENSIONS, ETC.—This torpedo-boat destroyer, recently completed, has finished her trials successfully. The mean of four runs over the measured mile was 30.11 knots. The other details are: Draft of water forward, 5.37 feet; aft, 8.9 feet; steam pressure at boilers, 249 pounds; vacuum, starboard, 23.3; port, 23.1; revolutions, starboard, 380.7; port, 380.4; mean I. H. P., starboard, 3382; port, 3193; total, 6575. The reported dimensions of the Lee are not in agreement, but the following are probably correct, or nearly so: Length, 210 feet; beam, 21 feet; mean draught, 7.2 feet; displacement, 350 tons. She will carry the same armament as the Syren, Greyhound, etc.

MYRMIDON: TRIALS.—The Myrmidon is a sister ship to the Syren, already described, and was built by the Palmer Company at Jarrow. She had her preliminary trials on February 7 when the results were: I. H. P., 6623; revolutions, 379.5; speed, 30.13. On the official 3-hour trial, which took place February 12, the following results were obtained: I. H. P., 6303; revolutions, 377; speed, 30.23 knots. The mean of six runs over the measured mile was 30.52 knots.

SYBILLE: WRECKED.—The second-class protected cruiser Sybille, of 3400 tons and 19 knots speed, launched in 1890, was wrecked in Lambert Bay, Cape Colony, January 16, 1901. The ship is a total loss but the crew and officers were all saved.

GREECE.

NEW CONSTRUCTION PROPOSED.—A bill establishing a special fund for the increase of the navy was introduced into the Greek parliament, but has not, so far as can be learned, been passed. The measure is much criticised by the Athenian papers, some of which declare that no money will be voted for military expenditure while the army and navy are controlled by the persons principally responsible for the disasters of 1897.

ITALY.

ESTIMATES FOR 1901-1902.—The estimates of naval expenditure for 1901-02, presented by the Minister of Marine to the Italian parliament, have not yet been voted; or, at least, no report of this has so far reached the compiler. The estimates call for a total expenditure of 115,277,800 lire ($22,248,615.40—1 lira = $0.193), of which 11,540,646 lire is for the merchant marine and 1,374,540 lire for extraordinary expenses. The sum allotted to the navy is 2,868,451 lire in excess of that voted last year, while that for the merchant marine is 2,695,100 lire less.

NAVAL PROGRAM, 1901-1904.—The Minister of Marine has presented a bill providing that from 1901 to 1904 an extraordinary credit of eight million lire will be devoted to new construction in addition to the provisions of the ordinary budget. During these four years the sums allotted to new construction are: 24,500,000 lire for 1901, and 24,000,000 lire for the other three years. The number of permanent workmen in the government yards is not to exceed 12,000; in case of urgent necessity others may be taken on as temporary laborers.

PERSONNEL: LIST OF OFFICERS.—A new decree fixes the number of officers as follows: 1 admiral, 7 vice-admirals, 14 rear-admirals, 58 captains, 160 *enseignes de vaisseau*, and 110 midshipmen. The other lists remain as before.

VITTORIO EMANUELE III, REGINA ELENA: DESCRIPTION.—These two new battleships are to be laid down this year in government yards, the Vittorio Emanuele III at Spezia and the Regina Elena at Castellamare. These were designed as sister ships, though it is rumored that the Regina Elena will carry three 12-inch guns, have slightly less coal capacity, and differ a very little in dimensions. There are strong reasons for doubting the correctness of this rumor, but no official details are at hand to definitely contradict it. The particulars which are given below are those of the original design and they are certainly true for the Vittorio Emanuele III. These ships have very moderate freeboard aft—probably about 12 feet—and about 21 feet forward. The superstructure extends from the bow to a short distance forward of the after 12-inch turret; but it is only the full width of the ship for a short distance from the stem and between the forward and after 8-inch turrets. Elsewhere it is cut away to give emplacements for the 8-inch turrets, or to permit fire directly ahead from the forward 8-inch guns. There are three smokepipes and two pole masts without military tops. The principal details are:

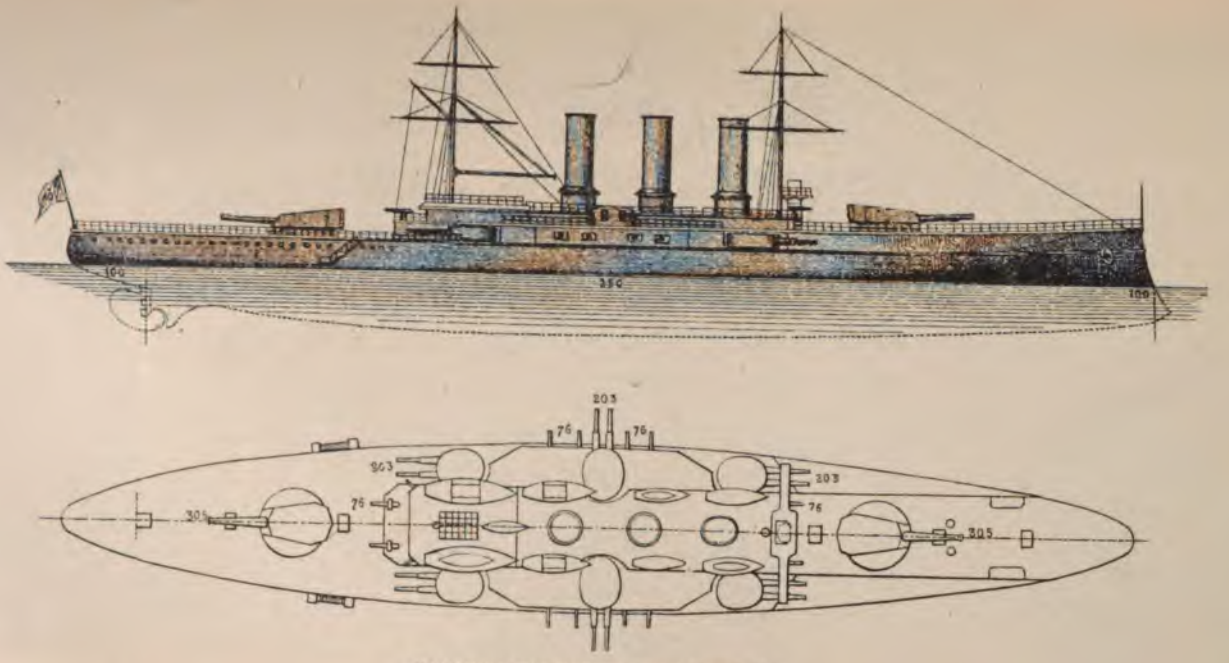
Armament.—Two 12-inch guns in turrets, one forward on the upper deck and one aft on the main deck. Twelve 8-inch guns in pairs in six turrets: two each side on main deck about 140 feet apart, and one each side on upper deck about halfway between the lower ones. Twelve 3-inch, of which eight are in the superstructure, four each side, between the 8-inch turrets. Twelve 3-pounders. Two above-water torpedo tubes, protected by armor, and two submerged tubes.

Protection.—Complete water-line belt 9.8 inches thick amidships and 3.9 inches at the ends. Side armor above belt, 5.9 inches. Thwartship bulkheads, 7.9 inches. Turrets of 12-inch guns, 6 inches; barbette towers, 7.9 inches. Turrets of 8-inch guns, 5.9 inches. Conning-tower, 9.8 inches. Signal tower, 1.96 inches. Protective deck, 2.9 inches on the slopes. All armor is to be Terni special, face-hardened.

Motive power.—Twin-screw engines. Water-tube boilers. Estimated I. H. P. of machinery, 20,000. Speed, 21.5 to 22 knots. Coal supply at load draft, 1000 tons; total capacity, 2000 tons. Radius of action, 10,000 miles at 10 knots.

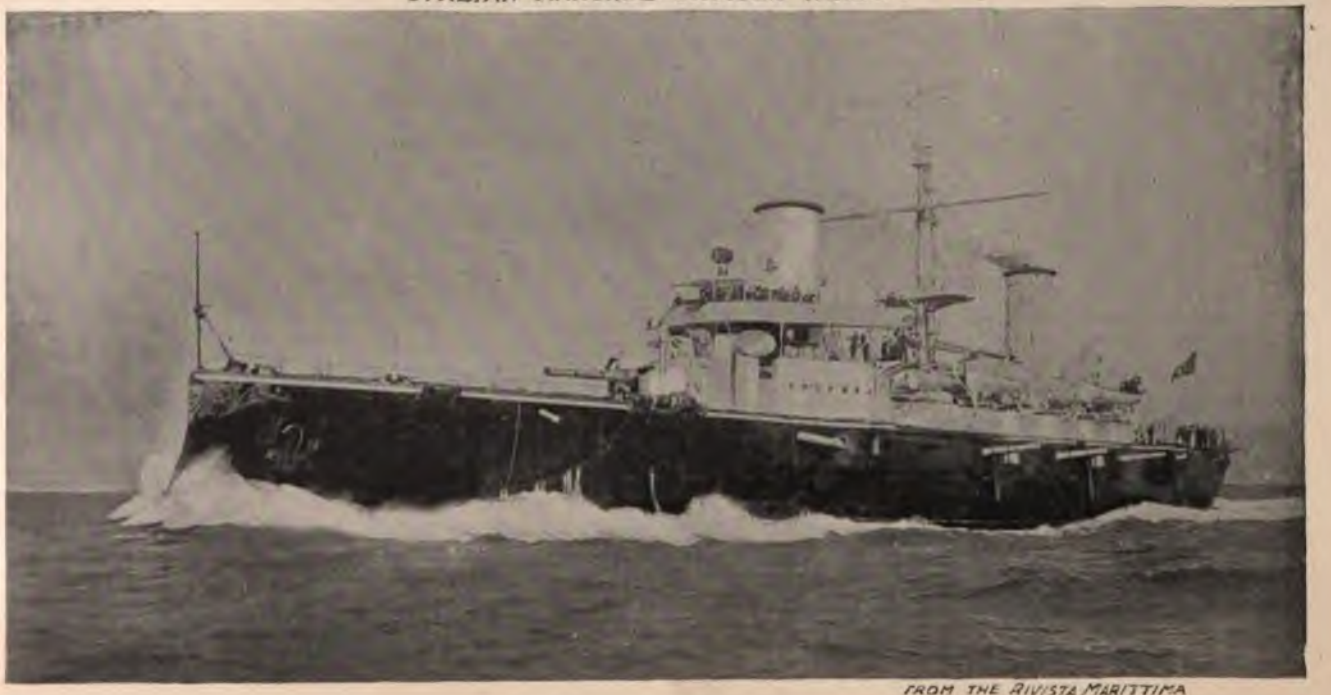
Dimensions.—Length between perpendiculars, 434.9 feet; length over all, 474 feet; beam, 73.5 feet; draft, 25.8 feet; displacement, 12,625 tons (metric).

GIUSEPPE GARIBALDI, VARESE: TRIALS, DESCRIPTION.—The Garibaldi, which is fitted with Niclausse water tube boilers, started on her preliminary trials July 12, 1900, but they were brought to an abrupt close by a distressing accident. Two of her boilers exploded within a few minutes of one another, killing one fireman instantly and badly burning and scalding two others. The cause of the disaster is unknown. The boilers were supposed to be in good order at the time. An inquiry into the causes of the explosion was ordered but no reports of the findings have been published so far as known to the compiler. After repairs and some alterations the Garibaldi completed her trials successfully. The results were as follows:



ITALIAN BATTLESHIP VITTORIO EMANUELE.
From the Rivista Marittima.

ITALIAN ARMORED CRUISER VARESE



FROM THE RIVISTA MARITTIMA

Kind of trial	Natural draft.	Forced draft.
Date	Aug. 17	Sept. 7
Duration of trial, hours	6	1.5
Steam at boilers, pounds	176.5	204.3
Steam at engines, pounds	138	155
Air-pressure, inches of water	—	.20 to .63
Revolutions, av. of both engines	89.3	106
Mean I. H. P.	9948	14,713
Mean speed, knots	16.2	19.7

All boilers were in use during both trials. The blowers were running during the natural draft trial but the fire rooms were not closed. The speed would have been greater if the bottom had been clean and the weather conditions more favorable.

The Varese, which is fitted with Belleville boilers, has also completed her trials, which passed off without stoppage or accident. The particulars are as follows:

Kind of trial	Nat. draft.	Forced draft.
Date	Oct. 20	Nov. 27
Displacement	7470	7475
Duration of trial, hours	6	1.5
Steam at boilers, pounds	155	201
Steam at engines, pounds	132	154
Coal used per sq. ft. of grate	17.87	24.98
Air-pressure, inches of water	—	.59 to .87
Revolutions	95.71	105.6
I. H. P.	9348	13,650
Speed, knots	18.352	20.02
Slip, per cent	16.84	17.8
Pitch of screw, feet	23.35	23.35

The ship came out of dock clean and freshly painted the morning of her natural draft trial. At the time of her forced draft trial she had been lying in the fitting out basin for nearly forty days. All boilers were in use at both trials. During the natural draft trials the blowers were running but the fire rooms were not closed.

The general appearance and arrangement of the Varese and Garibaldi class are similar to those of the Cristobal Colon. The midship superstructure extends between the barbettes of the heavier guns. The two smokepipes are 6.5 feet in diameter, extending 72 feet above the grate bars, are wide apart, and in the forward and after ends of the superstructure. One military mast placed amidships carries a large oblong top with its greatest diameter athwartships. Electrical power is ued for training the gun-houses, for ventilating engines, ammunition hoists, heating in pantry, lighting, etc. The hull is of steel without sheathing, divided into 250 water-tight compartments, of which 44 are in the double bottom.

Armament.—One 10-inch gun in a revolving gun-house over a barbette tower on the center line forward. Two 8-inch guns in a revolving gun-house over a barbette tower on the center line aft. Fourteen 6-inch guns: ten in central battery, five each side on gun deck; four on main deck in corners of superstructure. Ten 12-pounders: three on each side on main deck in superstructure; two each side on gun deck, one pair forward, and one pair aft. Six 3-pounders: four on the bridges; two in the top. Two machine guns. Four 17.7-inch torpedo tubes.

Protection.—Complete belt, 5 feet deep, 6 inches thick amidships tapering to 3.2 inches at the ends. Side armor above belt amidships covering gun-deck battery, 6 inches thick. Bulkheads at ends of battery, including bases of barbette towers, 4.7 inches. Armor around 6-inch guns in corners of superstructure, 6 inches. Protective deck 1.2 to 1.6 inches. Deck over battery, 1.9 inches. Barbette armor and fronts of gun-houses, 6 inches. Shields on all guns except those in gun-houses. Conning-tower, 4.7 inches.

Motive power.—Twin-screw, 3-cylinder, triple-expansion engines with cylinders 41, 63 and 93 inches diameter and 46 inches stroke. The Varese has 24 Belleville boilers in four fire rooms; and the Garibaldi 24 of the Niclausse type. The contract requirements with forced draft were: 13,500 I. H. P.; steam in boilers, 213 pounds; steam at engines, 155 pounds; revolutions not to exceed 116. Coal supply at load draft, 700 tons; total capacity, 1400 tons.

Dimensions.—Length over all, 357 feet; length between perpendiculars, 343.9 feet; beam, 59.7 feet; depth to main deck, 40 feet; mean draft, 23.3 feet; displacement, 7400 tons (metric) or 7326 tons of 2240 pounds.

JAPAN.

NEW TORPEDO-BOAT DESTROYERS.—The Minister of Marine has finally decided not to employ turbine engines for the new torpedo-boat destroyers on account of the large coal consumption at low powers. Two new destroyers, with engines of the ordinary type, have been ordered of Thorneycroft. They will be of 356 tons displacement and the machinery is to develop 7000 I. H. P. Two more destroyers of the Akebono class were ordered from Yarrow late in 1900.

HATSUSE: TRIALS.—This battleship of 15,000 tons has completed her trials. After docking, a 6-hour trial at four-fifths power gave a speed of 18 knots. With full power on a 3-hour trial the speed was 19 knots by revolutions. During the trial the ship made four runs over the measured mile, the mean of which was 19.1 knots. The Hatsuse is fully described in PROCEEDINGS No. 91, September, 1899.

VEDETTE BOATS: TRIALS.—Some vedette boats for Japanese battleships and cruisers were recently tried at Stokes Bay. The speed averaged about 18.5 knots, though one boat made 19.25 knots. The boats were built by Samuel White, of Cowes. The particulars are: Length, 56 feet; beam, 9.5 feet; depth, 5.25 feet; horsepower of machinery, 320; boilers, water-tube; total weight of machinery and boilers, 8 tons.

KATSURAGI: HAULED OFF REEF.—The small cruiser Katsuragi, of 1480 tons, which ran ashore on the coast of China during a typhoon, and which was reported wrecked, has been hauled off the reef without very serious injury.

YAEYAMA: NEW BOILERS.—The cruiser Yaeyama of 1600 tons, 5400 I. H. P., 19 knots speed, and launched in Japan in 1889, is to change her boilers and will receive new ones of the Niclausse type.

MEXICO.

For the first time in many years Mexico is building vessels for her little navy. One million Mexican dollars (about $480,000) has been appropriated to begin the work which is to be spread over five years. The vessels contemplated are eight gunboats of 1000 tons and 16 knots speed and two torpedo boats of moderate size.

NETHERLANDS.

BUDGET FOR 1901.—The Netherlands naval budget for 1901 amounts to 16,657,693.80 florins ($6,696,392.91—1 florin = $0.402). The following special items appear: Administration, $153,589.33; purchase of materials and expenses of new construction, $2,887,242.39; personnel, $1,776,573.88; for improvement of ports, coasts, pilot service, and hydrography, $1,008,-854.38; pensions and subsidies, $870,145.88. The amount allotted to new construction is charged with the sum of $1,688,400 for: (*a*) the completion of three torpedo boats; (*b*) for continuing the construction of the small battleships Konigin Regentes, De Ruyter, and a third of the same class not yet named; (*c*) for commencing an armored coast-defense vessel.

NEW PROGRAM.—The building program, presented to the Netherlands parliament about a year ago, contemplates building within ten years five ships of the Konigin Regentes class, two of the Holland class, three small coast-defense ships (2130 tons, 850 I. H. P., 10 knots speed), seven protected cruisers, three monitors, twenty-one sea-going torpedo boats of the Forban (French) type, twelve smaller torpedo boats, fourteen gunboats, and five sloops. The total expenditure involved is 74,500,000 florins ($29,949,000).

ASSAHAN: TRIAL, DESCRIPTION.—This gunboat has recently completed her trials. The mean speed was 14 knots and the average I. H. P. 1353. The principal details are:

Armament.—Two 4-inch guns; two 3-inch; two 1-pounders.

Motive power.—Twin-screw, triple-expansion engines. Coal capacity, 118 tons. Radius of action 2200 miles at 10 knots.

Dimensions.—Length, 177.1 feet; beam, 30.83 feet; mean draft, 11.8 feet; displacement, 810 tons.

NORWAY.

BUDGET FOR 1900-1901.—The total amount of the naval budget for 1900-01 is 4,485,000 crowns ($1,201,980—1 crown = $0.268), an increase of 28,000 crowns over that of 1899-1900. The principal allotments are as follows: Administration, 54,000 crowns; officers of ships, 274,000; medical corps, 37,000; enlisted men and petty officers, 335,000; personnel of torpedo defense, afloat and ashore, 65,000; workmen, 334,000; administration of navy yards, 159,000; changes of organization, 80,000; naval schools, 361,000; exercises and cruising expenses (including a sum of 30,000 for mobilization), 1,045,000; new construction, 800,000; maintenance of the material of the fleet (repairs), 138,000; torpedo mines, 34,000; guns, 197,000; hospital service, 17,000; material for construction, 153,000; expenses of navy yards, 270,000.

NEW CONSTRUCTION.—The new construction comprises the completion of first-class torpedo boats No. 7 and No. 8, and of the transport Fram; continuing the construction of first-class torpedo boats No. 9 and No. 10; and commencing the construction of second-class torpedo boats No. 18 and No. 19. The cost of rebuilding the first-class gunboat Sleipner is included in this vote.

RUSSIA.

BUDGET FOR 1901.—The Russian naval budget for 1901 provides for a total expenditure of 97,097,666 roubles ($50,005,297.99—1 rouble = $0.515), divided as follows:

	Roubles.
Ordinary expenses	66,000,000
Increase in schools	10,000
Increase of the fleet	16,000,000
Supplement to the ordinary budget	10,000,000
Improvement of the Port of Vladivostok	2,000,000
Expenditures for hydrographic service	54,700
Improvement of Port Arthur	3,000,000
Expenses of naval administration in Kwangtung	32,966
Total	97,097,666

This divided in the following manner:

	Roubles.
Administration	2,349,020
Rewards and assistance	545,278
Schools	1,132,767
Medical service and hospitals	1,203,777
Pay of officers, sailors, etc.	5,392,547
Provisions	1,890,774
Clothing	2,881,869
Ships in commission	20,318,803
Hydrographic service	1,007,609
Hydrography of the mouths of the Yenisei and Obi	54,700
Lighthouses	300,000
Guns	11,965,107
Shipbuilding	17,805,439
Repairs of ships	7,797,676
Navy yards and factories	5,822,669
Ships other than naval and their repairs	5,654,341
Expenses of travel, etc	840,000
Various expenses	1,637,634
Construction of Port Emperor Alexander III	3,200,000
Improvement of Port of Vladivostok	2,000,000
Improvement of fortifications of Port Arthur	3,000,000
Advances on the new budget	297,656
Total	97,097,666

The shipbuilding allotment of 17,805,439 roubles is to be applied a follows:

	Roubles.
1. Construction of hulls of ships	7,800,000
2. Construction of machinery	5,300,000
3. Construction of armor	3,400,000
4. Fitting out and equipping ships	1,000,000
5. Reserve fund for shipbuilding purposes	305,439
Total	17,805,439

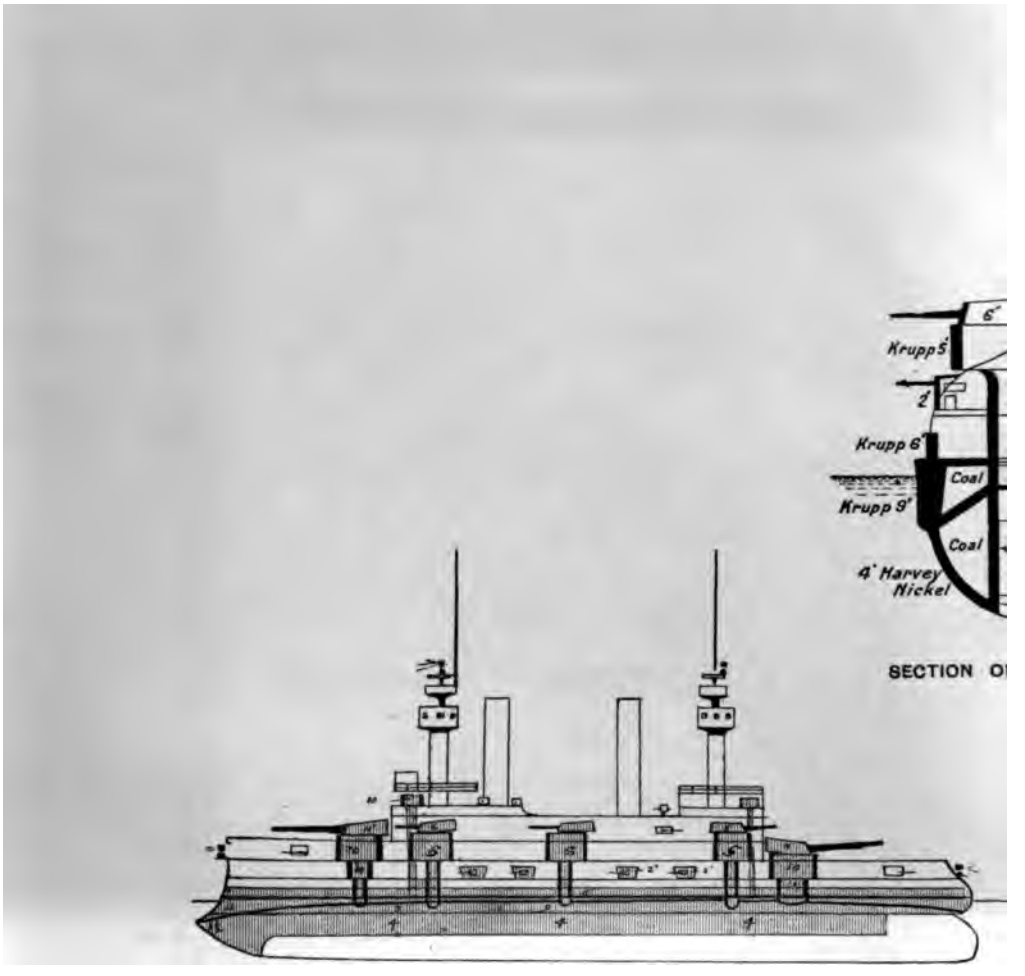
Item 1, construction of hulls, is subdivided as follows:

	Roubles.
Battleship Borodino at the New Admiralty Works	800,000
Battleship Orel, Galernaia I. Works	900,000
Battleship Imperator Alexander III, Baltic Works	1,400,000

	Roubles.
Battleship Kniaz Suvarov, Baltic Works	900,000
Cruiser despatch-vessel of 3000 tons, Baltic Works	680,000
Collier of 7200 tons, New Admiralty Works	500,000
Battleship of General-Admiral Apraksin type (5000 tons) New Ad. Works	450,000
Imperial yacht of the Alexandra type	100,000
Two 59-foot torpedo vedette boats for convoying the new yacht	50,000
Cruiser of 6250 tons, Nicolaiev dockyard	699,280
Six torpedo-boat destroyers of 350 tons, Nicolaiev dockyard	300,000
Cruiser of 6250 tons, Lazarev dockyard	699,280
Steam transport of 318 tons, Sormov Works	3,440
Twelve torpedo boats in sections for Port Arthur	318,000
Total	7,800,000

VESSELS BUILDING.

Name.	Displacement (tons).	Where building.	Remarks.
Battleships.			
Borodino	13,516	New Admiralty Works, St. P.	Not launched.
Imperator Alexander III	13,516	Baltic Works, St. Petersburg.	"
Orel	13,516	Galernaia I., St. Petersburg.	"
Kniaz Suvarov	13,516	Baltic Works.	"
Tsarevitch	12,900	La Seyne, France.	Launched Feb. 23, '01.
Kniaz Potemkin Tavrichesky	12,585	Nicolaiev, Russia.	Launched Oct. 9, 1900.
X	12,585	"	Reported ordered; doubtful.
Retvisan	12,700	Cramp's Yard, Philadelphia.	Launched Oct. 23, 1900.
Pobieda	12,674	Baltic Works, St. Petersburg.	Launched May 24, 1900.
Oslabya	12,674	New Ad. Wks., St. Petersburg.	Launched Nov. 8, 1898.
Admiral Butakov	5,000	" "	Ordered.
Cruisers.			
Bayan	7,800	La Seyne, France.	Launched June 12, '00.
Bogatyr	6,750	Vulcan Wks., Stettin, Germany.	Launched Jan. 30, 1901.
A	6,250	Nicolaiev.	Ordered.
B	6,250	Lazarev.	"
X	6,375	Libau, Russia.	Reported to be bldg.
Y	6,375	Galernaia I., St. Petersburg.	Proposed.
Z	6,375	" "	"
Askold	6,000	Germania Wks., Kiel, Germany.	Launched Mar. 13, '00.
Aurora	6,630	Galernaia I., St. Petersburg.	Launched May 24, '00.
Novik	3,000	Schichau, Elbing.	Launched Aug. 15, '00.
Boyarin	3,000	Burmeister & Wain, Copenhagen.	Launched Sep., 1900.
Cruiser despatch-vessel	3,000	Baltic Works, St. Petersburg.	Ordered.
Miscellaneous.			
Collier	7,200	New Ad. Works, St. Petersburg.	Ordered.
Imperial Yacht.	?	?	"
Transport	318	Sormov Works.	"



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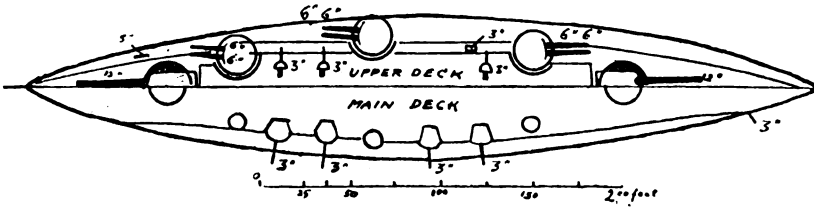

TSAREVITCH.

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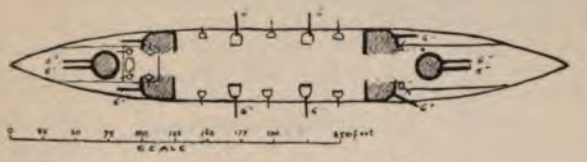
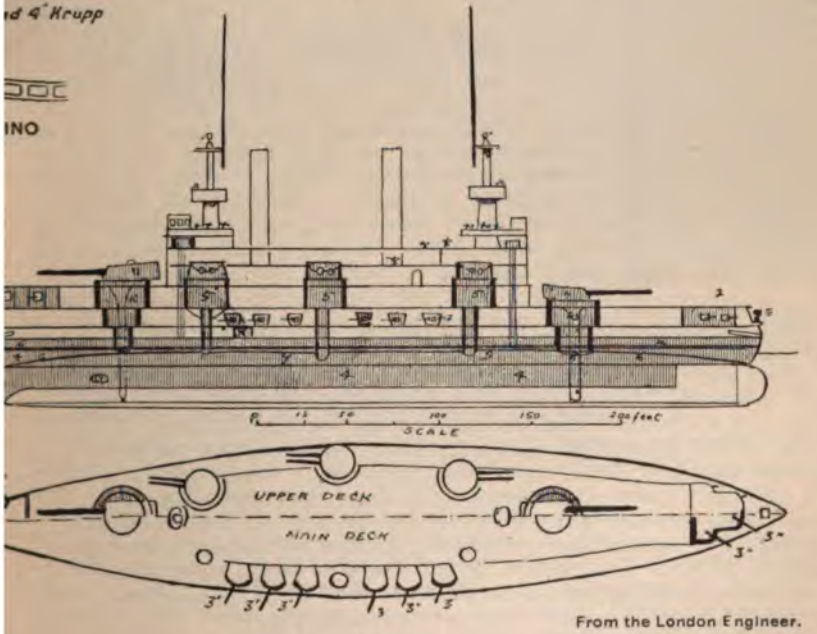


RUSSIAN CRUISER BOGATYR



From the London Engineer.

BORODINO.

HIPS.

VESSELS BUILDING—*Continued.*

Name.	Displacement (tons).	Where building.	Remarks.
Torpedo Boat Destroyers.			
Baklan	350	Nevsky Works, St. Petersburg.	Building.
Bekass	350	" "	"
Gorlitsa	350	" "	"
Kulik	350	" "	"
Perepel	350	" "	"
Skvorets	350	" "	"
Strij	350	" "	"
Chtchegol	350	" "	"
Albatross	350	New Ad. Works, St. Petersburg.	"
Drozd	350	" "	"
Diatel	350	" "	"
Six new boats	350	Nicolaiev.	Ordered.
Fasan	350	"	Practically complete.
Lebod	350	"	"
Pavlin	350	"	"
Pelikan	350	"	"
Osiotr	312	F. et C. de la M., Havre, France.	Launched Jan. 22, '01.
Forelle	312	" "	Launched Dec. 8, '00.
Losos	312	" "	Not yet launched.
Kefal	312	" "	"
Sterliad	312	" "	"
Kondor	220	? ?	Building.
Filin	220	Ijora Works, Russia.	"
Gagara	220	"	"
Krecet	220	"	"
Korsum	220	"	"
Sowa	220	"	"
Voron	220	"	"

BORODINO CLASS: DESCRIPTION.—There are four of this class under construction, as may be seen by a glance at the preceding table. So far as known they are exactly alike. According to some reports there are slight differences but the weight of authority is in favor of identical design and dimensions. The freeboard is high throughout, being 16 or 18 feet aft and 23 to 25 feet forward. Above the main deck the superstructure extends from the stem almost to the after turret; while above this, another superstructure extends between the turrets amidships. There are two military masts, each carrying one top and one searchlight platform. The special feature of these ships is the armor protection against torpedoes. The Tsarevitch, the prototype of the class, was the first to be so protected, and in the Borodino and her sisters the protection has been carried further. The principal details are:

Armament.—Four 12-inch guns in pairs in turrets forward and aft. Twelve 6-inch guns in six turrets, three on each beam, all slightly sponsoned, but only the midship one projecting beyond the beam at the water-line. The forward guns can fire directly ahead, the after ones directly astern, and the midship ones nearly ahead and nearly astern. Twenty 3-inch guns in casemates: six each side on the gun deck amidships; two each side on the gun deck aft; and two each side on the main deck forward. The 3-inch guns at the ends of the ship have fire parallel with the keel towards their own end of the ship. Twenty 3-pounders.

Eight 1-pounders. Four above-water torpedo tubes; two submerged tubes. The electric plant will be extensive and electric power will be used to operate the turrets, ammunition hoists, etc.

Protection.—Complete water-line belt, 9 inches thick amidships, tapering to 4 inches and 6 inches at the ends. Above this a complete narrow belt, 6 inches thick, except at the after end, where it is 4 inches. Below the main belt the torpedo defense belt, 4 inches thick, begins about 50 feet from the stern and ends at the stem, where it is only 1.5 inches thick, but deepened so as to cover the ram to the keel for a length of 25 or 30 feet. Inside the torpedo belt from the forward end of the fire-room to the after end of the engine room, a 4-inch vertical, armored bulkhead joins the lower edge of the torpedo defense belt to the knuckle of the protective deck where the slope joins the flat, thus forming a second defense against the explosion of torpedoes. Complete protective deck behind the main belt, from the lower edge of which the slopes of the deck rise. It is 3 inches thick on the slopes and 2 inches thick on the flat, the latter part being a little below water amidships and considerably more below at the ends. Two-inch flat armored deck on top of the belt, reduced in thickness at the ends. The turrets for the heavy guns are of the balanced type, 11 inches thick in front, and rest on barbette towers 10 inches thick, which rise a little above the deck and extend one deck down. Below that again there is a circular cylinder or tube of the same thickness but of less diameter, which, for the after guns, rests on the protective deck; but for the forward ones, being there one deck higher, there is a third armored cylinder of still smaller dimensions, connecting the intermediate cylinder to the protective deck. The 6-inch gun turrets are circular and 6 inches thick, placed over 5-inch barbette towers extending from a little above deck to the next deck below; thence connected to the protective deck by armored loading tubes. The case-mates of the 3-inch guns are 2 inches thick in front.

Motive power.—Twin-screw, triple-expansion engines of about 16,000 horsepower. The Borodino, Orel, and Suvarov will each have 20 Belleville boilers, while the Imperator Alexander III will have boilers of the Niclausse type. The designed speed is 18 knots. The coal supply at load draft is 1250 tons and the total capacity 2000 tons.

Dimensions.—Length over all, 397 feet; length between perpendiculars, 376 feet; beam, 76 feet; draft forward and aft, 26 feet; displacement at this draft, 13,516 tons.

NEW BATTLESHIP.—The *Kronstadt Vestnik* states that a new battleship of nearly 13,000 tons will soon be commenced at Nicolaiev. The length will be 390 feet, I. H. P. 17,000, and speed 18 knots. The further statement is made that the engines have already been ordered from the Sormov Works. This looks like an improved Tavrichesky. There is no provision for such a vessel in any recent budget, but the Russian budget is not always to be literally followed in considering cases of this kind. Nevertheless, the information may be regarded as doubtful.

ADMIRAL BOUTAKOV.—This third-class battleship has been commenced at the New Admiralty Works, St. Petersburg. Her plans have been changed three times (or at least the reports of them have) since she was first projected. The latest report, which corresponds with the statement in the budget for 1901, is that her displacement will be 5000 tons and that the battery will consist of one 12-inch gun in a closed turret forward, and four 6-inch guns in pairs in two closed turrets, one each side amid-

ships. The hull will be protected by a complete water-line belt of armor and a protective deck.

NEW CRUISERS OF 6250 TONS.—These two cruisers are building at the Nicolaiev and Lazarev Yards on the Black Sea. They are of the Bogatyr type and differ very little from that vessel. A proposition to replace four 6-inch guns by two or four 8-inch has not yet been approved. So that at present the description of the Bogatyr, given on a subsequent page, applies equally to these vessels except as regards dimensions. In respect to displacement the apparent difference is greater than the real. With the same amount of coal as the Bogatyr carries at load draft, these cruisers would displace 6470 tons instead of 6250, their coal supply at load draft being only 500 tons. (See illustration facing page 182.)

CRUISER DESPATCH-VESSEL.—This vessel, which may be similar to the Boyarin, is called a despatch-vessel in some recent reports which give her a displacement of 3500 tons. Her profile is said to resemble that of the Imperial yacht Standart. She will have Belleville boilers.

TSAREVITCH: LAUNCH, DESCRIPTION.—This battleship is building at the yard of the Compagnie des Forges et Chantiers de la Méditerranée, La Seyne, near Toulon, France, and was launched February 23, 1901. She is the prototype of the Borodino class and differs from them chiefly in having less displacement and lighter armor.

Armament.—Four 12-inch and twelve 6-inch guns arranged as in the Borodino (see description of Borodino on a preceding page). Twenty 3-inch guns: eight in armored sponsons, four each side amidships; one each side on gun deck aft; one each side on main deck forward; one each side in superstructure on upper deck; three each side on bridge deck; the twelve last mentioned are not protected by armor. Twenty 3-pounders. Eight 1-pounders. Four above-water torpedo tubes and two submerged tubes.

Protection.—Complete water-line belt, 9 inches thick amidships and 4 inches at the ends. Upper belt same as Borodino. Lower belt similar, but probably only 2 inches thick. Similar vertical armor bulkhead, 2 inches thick. Protective deck 2.5 inches thick on the slopes. Flat deck on top of belt 0.7 inch thick. Protection to battery same as Borodino.

Motive power.—Same as Borodino, except has three screws. Belleville boilers.

Dimensions.—Length over all, 388.8 feet; beam, 75.5 feet; draft, 26 feet; displacement, 12,900 tons.

KNIAZ POTEMKIN TAVRICHESKY: LAUNCH, DESCRIPTION.—This first-class battleship is building at the government yard, Nicolaiev, where she was commenced September 27, 1897, and launched October 9, 1900. She is similar in design to the Tri Sviatitelia, whose design, in turn, was based upon that of the British battleship Trafalgar. There is one military mast forward and a signal mast aft. Rather low freeboard. Hull of steel without sheathing.

Armament.—Four 12-inch guns of 40 calibers length in turrets forward and aft. Sixteen 6-inch of 45 calibers: eight in central battery, four each side; eight in pairs in turrets (probably in Canet twin mounts) over corners of central battery. Fourteen 3-inch of 40 calibers. Sixteen 1-pounders. Two Baronovski boat guns. Four submerged broadside torpedo tubes and one tube above water in the bows.

Protection.—The water-line belt is believed to be nearly complete. It is 9 inches thick amidships with 7-inch bulkheads. Armor over central

battery and on 6-inch turrets, 5 inches. Turrets of heavy guns, 12 inches thick in front. The protective deck is complete and 3 inches thick on the slopes. The redoubt above the belt and enclosing the bases of the heavy turrets is 9 inches thick. Splinter screens between guns in the central battery, 2 inches.

Motive power.—Twin-screw, triple-expansion engines. Fourteen Belleville boilers. The engines were built by the Nicolaiev Building Works and the contract requires that on four runs in smooth water the I. H. P. developed shall be not less than 10,600 and the speed 17 knots.

Dimensions.—Length between perpendiculars, 370.7 feet; beam, 73 feet; mean draft, 27 feet; displacement, 12,585 tons.

RETVISAN: LAUNCH, DESCRIPTION.—This first-class battleship is building at the yard of the William Cramp & Sons' Shipbuilding Company, Philadelphia, where it was launched October 23, 1900. The general arrangement of armor and battery is similar to that of the Formidable class in the British navy. The hull is of steel without sheathing and with the usual double bottom and water-tight compartments. There are two masts, each carrying one military top and one searchlight platform. The forecastle and poop are at the same deck level. Between them on the main deck there is a superstructure rising one deck height. The complement is 38 officers and 700 men.

Armament.—Four 12-inch guns of 40 calibers in balanced turrets forward and aft with arc of train of 270 degrees. Twelve 6-inch guns of 45 calibers: four each side in casemates on the gun deck with arc of fire of 120 degrees; and two each side in casemates on the main deck with arc of fire of about 170 degrees, forward guns firing a little across the bow and after guns firing a little across the stern. Twenty 3-inch guns of 50 calibers: three each side on the main deck in the superstructure; two each side on the gun deck forward and two each side aft; lastly, one each side on the superstructure. Twenty 3-pounders, of which six are on the forward bridge deck and six are on the after one. Six 1-pounders. Two submerged torpedo tubes and four above-water tubes. The turrets and the ammunition hoists of all guns are operated by electricity.

Protection.—Water-line belt amidships between the turrets 9 inches thick and 7.5 feet wide, extending 4 feet below and 3.5 feet above water at normal draft. Above this belt the side is covered with a second belt of 6-inch armor up to the level of the gun deck. The ends of the 9-inch and 6-inch belts are joined to the barbette towers of the 12-inch guns by diagonal bulkheads of 9-inch and 6-inch armor respectively. Forward of this armor, for a depth equal to that of both belts, the hull is covered with 2-inch plating which extends down to the ram at the stem, following the edge of the protective deck. The protective deck extends from stem to stern, the sides sloping down to meet the lower edge of the belt; the flat, amidships, being about at the level of the load water-line. The slopes behind the 9-inch belt are 3 inches thick; forward and aft they are increased to 4 inches. The flat is 2 inches thick throughout. The turrets and barbette towers in the original design were 10 inches thick throughout but there is a strong probability that turrets and barbette towers similar to those of the Maine will be installed. The casemates are 5 inches thick. All armor over 3 inches thick is face-hardened by the Krupp process.

Motive power.—Twin-screw, 3-cylinder, triple-expansion engines with cylinders of 38.5, 59 and 92 inches diameter and 42 inches stroke. Twenty-

four Niclausse boilers in four compartments, designed to furnish steam at 256 pounds, reduced to 200 pounds at the engines; grate surface, 1353 square feet; heating surface, 58,104 square feet; three smokepipes, 100 feet high above grate bars. The designed I. H. P. of the machinery is 16,000 and the requirements of the contract are that the ship shall maintain a speed of 18 knots for 12 hours with natural draft. The total coal capacity is 2000 tons; in addition, certain compartments of the double bottom are fitted as tanks for containing liquid fuel.

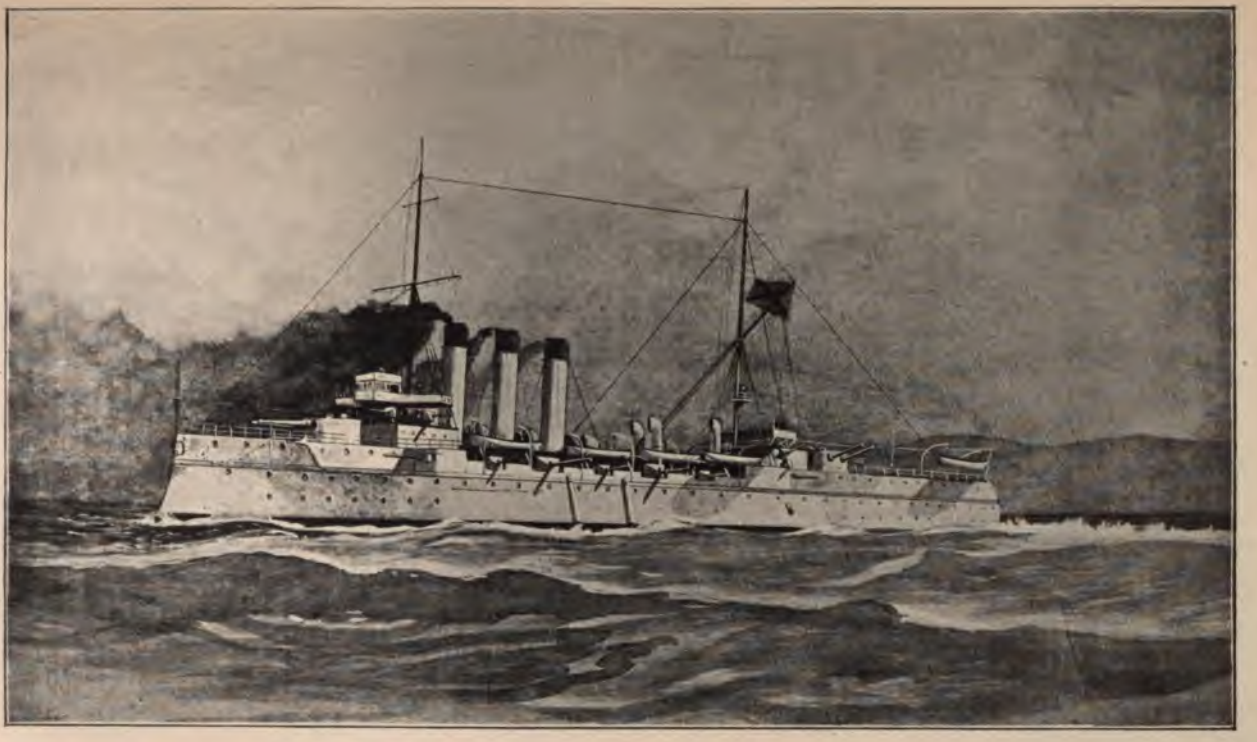
Dimensions.—Length on load water-line, 384 feet; beam, 72.2 feet; depth to main deck, 43.8 feet; draft, 25 feet; displacement at this draft, 12,800 tons.

BOGATYR: LAUNCH, DESCRIPTION.—The Bogatyr and Variag, like the new 6250 ton ships, are developments of the Pallada type. The increase in displacement is very little, the added weights being possible through economies in weight carried by the earlier vessels. The Bogatyr was built at the yard of the Vulcan Company, Stettin, Germany, where she was launched January 30, 1901. The freeboard is high forward and aft but somewhat less amidships. Above the main deck there is a forecastle of moderate dimensions and a very long poop. The bridge deck is over a broad deck-house on the after end of the forecastle, forward of the foremast; above this are the bridge and pilothouse. There are two pole masts and three smokepipes, the latter very far forward. The vessel carries two steam launches, one petroleum boat, and seven pulling boats. The complement is 21 officers and 550 men. The hull is of steel without sheathing. (See plans facing page 178.) The principal details are:

Armament.—Twelve 6-inch Obukov guns of 45 calibers (closely resembling the Canet model): four in pairs in closed turrets on the poop and forecastle; four in armored casemates on the main deck, one each side at after end of forecastle firing directly ahead, and one each side at forward end of poop firing directly astern; two each side on the main deck protected by shields. Twelve 3-inch guns of 50 calibers: three each side on main deck, four on the forward deck-house, and one each side on the forward end of the poop. Six 3-pounders. Four small guns. Two submerged torpedo tubes and two above-water tubes, one in the bow and one in the stern. Six searchlights: two on the forward bridge, two on the platform over the pilothouse, and two on the after bridge. There are two ammunition hoists for the turrets, four for the casemates, two for the 6-inch guns on the main deck amidships, three for the 3-inch guns, and two for the 3-pounders. They are worked by electric or hand power.

Protection.—Complete protective deck, 1.2 inches thick on the flat, 2.7 inches on the slopes amidships and 2.1 inches on the slopes at the ends. This deck consists of two thicknesses of plates screwed together, the upper layer being of nickel steel. The turrets of the 6-inch guns are 4.9 inches thick in front and 3.6 inches in rear; the front plates are face-hardened, the rear ones of nickel steel untreated. The casemates are 3.2 inches thick in front, closed in rear by plates of 1.4 inches. The ammunition hoists are in armored tubes 2.4 inches thick. The conning-tower on the forward bridge deck is 5.5 inches thick and the curved shield covering its entrance 3.5 inches. Both shield and tower are of face-hardened steel.

Motive power.—Twin-screw, 4-cylinder, triple-expansion engines. Sixteen Normand water-tube boilers. The designed horsepower of the machinery is 20,000 and the anticipated speed 23 knots. The coal supply at load draft is 720 tons and the total capacity 1430 tons.



RUSSIAN FIRST-RATE PROTECTED CRUISER, IMPROVED BOGATYR TYPE.
From the London Engineer.

Dimensions.—Length over all, 440.2 feet; length on water-line, 433 feet; beam, 54.4 feet; depth, 34.1 feet; mean load draft, 20.8 feet; displacement at this draft, 6750 tons.

PERESVIET: TRIALS.—The last trials of this battleship of 12,674 tons, which took place recently, were regarded as satisfactory although the horsepower was 725 below the requirements of the contract. The engines worked well, which was not the case on the first trial, as they had to be stopped on account of serious heating of the bearings. The deficiency in horsepower was attributed to irregular working of the boilers which experience will correct. The first, or preliminary trial, which took place about a year ago, gave results as follows: I. H. P., 14,532, or 32 over the contract; steam pressure, 169.5 pounds; speed not reported. The results of the last 6-hour trial were: I. H. P. of port engine, 4637.42; I. H. P. of middle engine, 4692.84; I. H. P. of starboard engine, 4445.11; total I. H. P., 13,775.37; average speed, 19.12 knots; average revolutions, 102; steam at boilers, 165 pounds; steam at engines, 139 pounds.

GROMOVOI: TRIALS.—The last trial of this armored cruiser of 12,336 tons took place in October, 1900, and gave the following results:

	Port engine.	Middle engine.	Starb. engine.	Total or average.
I. H. P.	5165	5274.44	5056.57	15,496
Revolutions	123	117.5	124.23	121.58
Steam at engines, pounds	165	171.3	173.3	169.9

The horsepower developed was 996 above the requirement of the contract. The speed is not reported, but was probably a little over 20 knots.

NICOLAI I: TRIALS UNSATISFACTORY.—This second-class battleship of 9700 tons, launched in 1889, had had her old cylindrical boilers removed and replaced by 16 of the Belleville type. Several trials, all giving about the same results, have shown the new boilers to be entirely inadequate to produce sufficient steam for the engines to develop their full power. So far the power developed has been only about 5000 instead of 8000, which is the capacity of the engines.

BAKLAN, BEKASS, GORLITSA, GRACH, KULIK, PEREPEL, SKVORETS, STRIJ, CHTCHEGOL: DESCRIPTION.—These torpedo-boat destroyers are building at the Neva Works, St. Petersburg. The hull is of steel with the usual watertight subdivision. The screws are protected as in the destroyers of the Sokol class. Each compartment will be fitted with a turbine capable of ejecting 80 tons of water an hour and there will be seven 5-inch hand pumps worked from the upper deck. All of the boats should be completed by May, 1902. The principal details are:

Armament.—One 3-inch gun, five 3-pounders, and three torpedo tubes.

Motive power.—The engines are twin-screw, 4-cylinder, triple-expansion, with cylinders 20.5 inches, 31.5 inches, 34 inches, and 34 inches in diameter. The boilers are four in number and of the Yarrow type, with a total grate area of 240 square feet and a heating surface of 12,800 square feet. The designed horsepower of the machinery is 4500 and the expected speed 26 knots. The coal capacity is 80 tons.

Dimensions.—Length, 210 feet; beam, 21 feet; mean draft, 5.8 feet; displacement, 350 tons.

OSETR, KEFAL, LOSSOS, FORELLE, STERLIAD: DESCRIPTION.—These five torpedo-boat destroyers are building at the Havre shipbuilding yard of the Forges et Chantiers de la Méditerranée Company. All are well

advanced. The Forelle was launched December 8, 1900, and the Osetr January 23, 1901. Every attempt has been made to lighten the weights carried without reducing strength or stiffness. All the outer sheathing and angles are of nickel-steel (4 per cent nickel), and in spite of the difficulty of working this material the finish is neat. The plates under water and for some distance above it are galvanized (or more properly zinc-coated). The particulars are:

Armament.—One 3-inch gun, five 3-pounders, two torpedo tubes.

Motive power.—Twin-screw, vertical, triple-expansion engines designed to develop 4750 horsepower with 310 revolutions. Four Normand water-tube boilers. The contract requires one trial of 8 hours at 14 knots; a 6-hour trial at maximum power for this length of time; a run at 22 knots on which the behavior of the engines and boilers is to be noted; and within two hours after its completion another trial at full speed. If the speed is less than 26 knots on the 6-hour full speed trial, but more than 24 knots, a boat may be accepted but the price will be subject to a reduction of 15,000 francs for each quarter of a knot above 25 and 25,000 francs for each quarter of a knot below 25. The total cost of each boat is about $300,000.

Dimensions.—Length, 187 feet; beam, 20.66 feet; draft, 6.5 feet; displacement at this draft, 312 tons.

SPAIN.

The building program of the cabinet which resigned in October included eight battleships of 12,000 tons, four armored cruisers of 8000 tons, and one hundred torpedo-boat destroyers and torpedo boats. Whether the present or some future administration will take up this program or devise another is uncertain. At present the scheme is laid aside. The Minister of Marine has proposed, and the proposal has been approved by the Spanish parliament, that the strength of the fleet in commission during the current year shall be as follows:

In home waters: one battleship (Pelayo), two coastguard vessels (Vitoria and Numancia), and one protected cruiser (Carlos V).

For special service: one third-class protected cruiser (Rio de la Plata), three third-class cruisers (Isabella II, Infanta Isabella, and Conde de Venadito), three torpedo gunboats (Vicente Yanez, Pinzon, Nueva España, and Temerario), two first-class gunboats, two despatch vessels, and four small craft.

The Liga Maritima Española has recently been formed and issues a *Boletin* of its own, the first number of which appeared on January 1. Like the British and German Navy Leagues it is devoted to the rebuilding and improvement of the navy.

TURKEY.

New Cruiser.—The new cruiser to be built at Cramps for the Turkish navy will be somewhat similar to the Denver but very much faster, the designed speed being 22 knots. The contract for the construction was signed December 24, 1900; but, according to late reports, the first payment had not been made, so that the actual construction had not yet commenced.

Repairs to Old Ships.—A contract has also been signed for the repair of the old battleship Assat-i-Tewfik at the Germania Yard, Kiel.

The other old battleships Mahmudieh, Feth-i-Bulend, Avni-Illah, Muin-i-Zaffer, and Mukadami-i-Häir are to be rebuilt at the yard of Ansaldo Brothers, Sampierdarena, near Genoa, where the work of rebuilding the Messudieh has already begun. Some difficulty is expected in getting the ships to Genoa, as most of them are unable to go under their own steam.

TORPEDO-BOAT DESTROYERS.—Two torpedo-boat destroyers, built for the Italian navy but reported as rejected for some reason, have been sold to Turkey. On trial the speeds were 27.1 knots and 27.4 knots, instead of 26 knots, the contract requirement.

UNITED STATES.

NAVAL APPROPRIATION BILL, 1901-1902.—The Naval Appropriation bill as finally passed provides for 22,500 enlisted men, 2500 naval apprentices and 50 additional warrant machinists.

Officers of the Navy, and officers and men of the Marine Corps, when detailed for shore duty in Alaska, Philippine Islands, Guam, or elsewhere beyond the continental limits of the United States, shall be considered as having been detailed for "shore duty beyond seas" and shall receive pay accordingly, with such additional pay as may be provided by law for service in island possessions of the United States.

Officers advanced in rank for meritorious service in the war with Spain will be carried as additional members in their own grade and be promoted with the number next ahead.

The Secretary of the Navy is directed to have the coast of Puerto Rico examined for determining the best site for a naval station and to report the result of the investigation to Congress. He is similarly directed in the case of the Philippine Islands.

The paragraph in regard to commissioning warrant officers is as follows: "Whenever, in view of the vacancies in the grade of ensign on July thirtieth of any year unfilled by graduates of the Naval Academy, the Secretary of the Navy shall so recommend, the President may appoint to that grade, as of July thirtieth, from among the boatswains, gunners, or warrant machinists, not exceeding six in any one calendar year. No person shall be so appointed who is over thirty-five years of age; who has served less than six years as a warrant officer; who is not recommended by a commanding officer under whom he has served; nor until he shall have passed such competitive examination as may be prescribed by the Navy Department."

The President is authorized to establish, and from time to time to modify, as the needs of the service may require, a classification of vessels of the navy, and to formulate appropriate rules governing assignments to command of vessels and squadrons.

Some of the most important items are as follows:

Pay miscellaneous	$ 600,000
Emergency fund, to be expended at the discretion of the President, and $50,000 to be immediately available	250,000
Outfits for 2500 naval apprentices, 100 hospital apprentices, and 5000 landsmen, at $45 each	342,000
Naval Training Stations: California, $30,000; R. I., $45,000	75,000
War College, $9200; Naval Home, $76,425	85,625
Ordnance and ordnance stores: procuring, preserving and handling material, etc., and target practice	500,000

Reserve supply of ammunition, $500,000; conversion of 6-inch guns to R. F. G., $25,000; purchase and manufacture of smokeless powder, $500,000; new machinery at gun factory, $150,000; reserve guns for auxiliary cruisers, $250,000; Torpedo Station, $65,000	1,490,000
Naval militia: arms, equipments, boats, books of instruction, etc.	60,000
Small arms, machine guns, R. F. G., ammunition, etc., for Marine Corps	100,000
Naval proving ground, additional land	25,000
Purchase, transport, storage, and handling of coal	2,000,000
Equipment of vessels	1,500,000
Hydrographic surveys and purchase of sailing directions, charts, books, etc.	100,000
To establish new coal depots at the discretion of the Secretary.	600,000
Land for naval station and for harbor and channel defense, Pearl Harbor, Hawaiian Islands	150,000
Civilian crews and expenses of naval colliers	350,000
Yards and docks, maintenance	500,000
Public works at Portsmouth navy yard: quay wall, grading, new offices, floating derrick, boat shop, general storehouse, etc.	364,500
Public works at Boston navy yard: new shops, extensions, etc., piers, wharves, paving, fire-protection system, saw-mill, spar shed, coal handling and storage plant, etc	551,000
Public works at New York navy yard: boathouse, to continue work on granite and concrete dock ($300,000), fire-protection system, dredging, coal handling and storage plant ($100,000), piers on cob dock ($88,000), ordnance storehouse and slip, reconstruction and extension of buildings, quay wall, etc	1,009,000
Public works at Philadelphia navy yard: extension of basin, electrical shop, retaining walls, new shops and extensions, extension of piers, general storehouse, sea-wall, etc	695,230
Public works at Washington navy yard: new shops, extensions, etc.	318,210
Public works at Norfolk navy yard: to continue work on granite and concrete dock ($300,000), quay wall, fitting out basin, mooring slips, alterations and extensions	594,260
Public works at Mare Island navy yard: new shops and storehouses and completing, fire-protection system, fire boat, etc.	331,660
Public works at Puget Sound navy yard: grading, coal sheds and coaling appliances, new shops and extensions, fire protection, quarters for gunner, etc.	273,000
Public works at San Juan naval station: coaling facilities, etc.	40,000
Public works at Pensacola navy yard: coaling plant, wharves, etc.	41,500
Public works at Algiers naval station: shops and offices, coaling plant, purchase of land, etc.	330,000
Public works at Dry Tortugas: dredging channel	100,000
Four dry docks: towards completion of dry docks at Portsmouth, N. H., Boston, Philadelphia, and Mare Island	1,000,000
Public works at naval station, Hawaii: machine shop and smithery, foundry, commandant's house and stable, extending office building, cottage for watchman, water-pipe system, grading and fencing, etc.	107,300
Public works at Tutuila naval station: coaling plant ($200,000), grading ($25,000)	225,000

Public works at Charleston, S. C., naval station: concrete and stone drydock ($150,000—cost not to exceed $1,250,000); also all appropriations for Port Royal naval station made prior to June 7, 1900, and still unexpended, made available for Charleston station	150,000
Repairs and preservation at navy yards and stations	500,000
Total for public works, Bureau of Yards & Docks	6,775,010
The Secretary is directed to report to Congress the condition and extent of public land on Blythe Island, Georgia; whether the title is good and whether the land is adapted to the needs and necessary wants of the Navy Department; to establish and mark the boundary line of this property and to lay out rifle range and construct boat landing, there is appropriated	2,000
Naval Academy: construction of buildings and necessary improvements	3,000,000
Naval Training Stations (Public works, Bu. Nav.): California, $6000; R. I., $52,175	58,175
Public works, Bureau of Ordnance: Iona Island, $100,000; Dover, $65,000; Fort Mifflin, $56,000; Norfolk magazine, $60,500; Torpedo station, $25,000; Indian Head proving ground, $11,600	318,100
Bureau of Medicine & Surgery, total	210,000
Provisions for the navy	3,250,000
Bureau of Construction and Repair: general fund for repair, preservation, and completion of ships	7,000,000
Improvement of construction plants at navy yards and stations.	335,000
Bureau of Steam Engineering: general fund for care and preservation, and completion of new work	2,120,000
Purchase of material and stores and care of same and of machinery, etc., on shore	1,110,000
Machinery plant, Philadelphia	100,000
Machinery plant, Mare Island	100,000
Marine Corps: pay and allowances of officers on the active list.	416,900
Pay of non-commissioned officers and privates, etc	1,112,548
Provisions, etc., for men on shore	371,071.50
Clothing	290,199.54
Increase of the Navy:	
The Secretary is directed to prepare plans for two battleships and two armored cruisers and submit same to next Congress. No appropriation. Also to review and further consider the questions of sheathing, weight and extent of armor, form and location of turrets, as to whether changes are desirable in number and kind of guns carried, what torpedo tubes should be built in large ships, and all other important questions now pending among naval architects and ordnance experts concerning battleships and cruisers; which review and opinion he is to transmit to Congress, so far as he may deem it expedient to do so; and he is authorized to use his discretion in regard to sheathing or not sheathing any vessels already appropriated for.	
Increase of the Navy: construction of hulls, outfits and machinery of vessels authorized	21,000,000

Increase of the Navy: armament and ammunition for vessels authorized 4,000,000
Increase of the Navy: equipment of vessels authorized..... 400,000

VESSELS BUILDING.—The following was the degree of completion of vessels under construction for the United States Navy on February 1, 1901, as shown by the records of the Bureau of Construction and Repair: Battleships—Illinois, 88 per cent; Maine, 42 per cent; Missouri, 23 per cent; Ohio, 37 per cent; No. 13, 0 per cent; No. 14, 0 per cent; No. 15, 0 per cent. Armored cruisers—No. 4, 0 per cent; No. 5, 0 per cent; No. 6, 0 per cent; No. 7, 0 per cent; No. 8, 0 per cent; No. 9, 0 per cent. Sheathed protected cruisers—Denver, 38 per cent; Des Moines, 15 per cent; Chattanooga, 19 per cent; Galveston, 9 per cent; Tacoma, 14 per cent; Cleveland, 44 per cent. Monitors—Arkansas, 47 per cent; Nevada, 79 per cent; Florida, 59 per cent; Wyoming, 68 per cent. Torpedo-boat destroyers—Bainbridge, 88 per cent; Barry, 86 per cent; Chauncey, 87 per cent; Dale, 90 per cent; Decatur, 90 per cent; Hopkins, 70 per cent; Hull, 69 per cent; Lawrence, 99 per cent; Macdonough, 98 per cent; Paul Jones, 82 per cent; Perry, 89 per cent; Preble, 82 per cent; Stewart, 47 per cent; Truxton, 54 per cent; Whipple, 53 per cent; Worden, 53 per cent. Torpedo boats—Stringham, 98 per cent; Goldsborough, 99 per cent; Bailey, 99 per cent; Bagley, 98 per cent; Barney, 99 per cent; Biddle, 97 per cent; Blakely, 98 per cent; De Long, 98 per cent; Nicholson, 84 per cent; O'Brien, 88 per cent; Shubrick, 97 per cent; Stockton, 99 per cent; Thornton, 95 per cent; Tingey, 67 per cent; Wilkes, 75 per cent. Submarine torpedo boats—Plunger, 5 per cent; Adder, 27 per cent; Grampus, 6 per cent; Moccasin, 18 per cent; Pike, 5 per cent; Porpoise, 15 per cent; Shark, 12 per cent.—*Army & Navy Journal.*

CONTRACTS FOR NEW VESSELS.—The contracts for the new battleships and cruisers have been awarded as follows:

Name.	Where building.	Contract price.	Cont. signed.
Sheathed battleships.			
Virginia (No. 13)	Newport News Co.	3,590,000	No report.
Nebraska (No. 14)	Moran Bros., Seattle.	3,733,000	"
Georgia (No. 15)	Bath Iron Works.	3,590,000	"
Unsheathed battleships.			
New Jersey (No. 16)	Fore River Works.	3.405,000	"
Rhode Island (No. 17.) ...	"	3,405,000	"
Armored cruisers, sheathed.			
Pennsylvania (No. 4)	Cramp, Philadelphia.	3,890,000	Jan. 10, 1901.
West Virginia (No. 5)....	Newport News Co.	3,885,000	Jan. 24, 1901.
California (No. 6).....	Union Iron Works.	3,800,000	Jan. 10, 1901.
Armored cruisers, unsheathed.			
Colorado (No. 7).....	Cramp, Philadelphia	3,780,000	Jan. 10, 1901.
Maryland (No. 8)	Newport News Co.	3,775.000	Jan. 24, 1901.
South Dakota (No. 9)	Union Iron Works.	3,750,000	Jan. 10, 1901.
Protected cruisers.			
St. Louis (No. 21)	Neafie & Levy, Phila.	2,740,000	?
Charleston (No. 22).....	Newport News Co.	2,740,000	?
Milwaukee (No. 20)	No satisfactory bid; readvertised March 7.		

According to reports received too late for verification the name Pennsylvania has been transferred to Armored Cruiser No. 4 and that of

Nebraska transferred to Battleship No. 14. Several reports concur in this. These vessels were all completely described in the last number of the PROCEEDINGS (No. 96). It is also reported that the Board of Construction has decided that none of the battleships or armored cruisers will be sheathed. This will necessitate changes in the contracts.

ARKANSAS, NEVADA: LAUNCH.—The Arkansas was launched at Newport News, November 10, 1900; and the Nevada at Bath, Me., November 24. Both are of 3235 tons and sister ships in all respects to the Wyoming, fully described in PROCEEDINGS No. 96, page 717.

ALABAMA: FINAL TRIAL.—The final trial of the Alabama in commission, which took place very recently, was satisfactory in all respects. The speed with natural draft was 16.2 knots and the corresponding horsepower was 7506.

ILLINOIS: PRELIMINARY TRIAL.—The preliminary builder's trial of the battleship Illinois, 11,565 tons, took place on March 11. It was satisfactory in all respects. The official trial will probably take place in April.

BAGLEY: LAUNCH, DESCRIPTION.—This first-class torpedo boat was launched at the Bath Ironworks, Bath, Me., September 25, 1900. She is one of three building at this yard; the others being the Barney, which was launched in July, 1900, and has had preliminary trials, and the other the Biddle, which has not yet been launched. These boats are similar in all respects; the complement is 3 officers and 26 men; and the principal details are:

Armament.—Three 17.7-inch torpedo tubes; three semi-automatic 3-pounders.

Motive power.—Twin-screw, vertical, quadruple-expansion engines. Normand water-tube boilers. Designed I. H. P. of machinery, 4200; speed, 28 knots.

Dimensions.—Length on load water-line, 157 feet; extreme breadth, 17 feet; mean draft, 4.65 feet; extreme draft aft, with bunkers full, 8 feet; displacement, 167 tons.

BLAKELY, DE LONG: LAUNCH, DESCRIPTION.—These first-class torpedo boats are similar in all respects and were built at the yard of Messrs. George Lawley & Sons, South Boston, Mass., where they were launched, the Blakely on November 22 and the De Long on November 23. The keels of these boats were laid January 12, and January 24, 1899, respectively. The contract price was $159,400 each and they were to have been completed in one year from the date of the contract, which was September 27, 1898; but, as has been the case with all the torpedo boats, the construction has been slow. The complement is 3 officers and 26 men; and the principal details are:

Armament.—Three 17.7-inch torpedo tubes and three semi-automatic 3-pounders.

Motive power.—Twin-screw, vertical, quadruple-expansion engines. Three Thorneycroft water-tube boilers, two in a compartment forward of the engines and one in a compartment abaft them. Designed I. H. P. of the machinery, 3000; speed, 26 knots. Coal supply, 10 tons; bunker capacity, 70 tons.

Dimensions.—Length on load water-line, 175 feet; extreme breadth, 17.5 feet; mean draft, 4.67 feet; maximum draft aft with stores and full bunkers, 7.5 feet; displacement, 165 tons; tons per inch of draft at mean load, 5.4.

LAWRENCE, MACDONOUGH: LAUNCH, DESCRIPTION.—These torpedo-boat destroyers are building at the yard of the Fore River Engine Com-

pany, Weymouth, Mass. The Lawrence was launched on November 7, and the Macdonough on December 24, 1900. They are alike in all respects. The contract for the construction was signed September 29, 1898, and the keels laid on April 10, and April 21, 1899, respectively. The contract price was $281,000 each. As the contract time was two years it has already been considerably exceeded. The hull is of steel, galvanized to one foot above the load water-line. The complement is 4 officers and 69 men. The principal details are:

Armament.—Two 3-inch, 50 caliber guns; five semi-automatic 6-pounders; two tubes for long 17.7-inch torpedoes.

Motive power.—The engines are twin-screw, vertical, triple-expansion, with cylinders 22, 31, 34, and 34 inches diameter and 20 inches stroke. The boilers are of the Express type, water-tube, with grate area of 320 square feet and heating surface of 18,000 square feet. The designed horsepower of the machinery is 8400 corresponding to a speed of 30 knots at 360 revolutions. The normal coal supply is 34 tons and the total capacity 115 tons.

Dimensions.—Length on load water-line, 242.25 feet; extreme breadth, 22.25 feet; mean draft, 6.18 feet; displacement, at this draft, 400 tons; tons per inch of immersion at normal draft, 8.56.

PERRY, PREBLE: LAUNCH, DESCRIPTION.—These two torpedo-boat destroyers are building at the Union Ironworks, San Francisco, Cal. The contract was signed October 5, 1898, and the boats were to be delivered in eighteen months. The contract price was $285,000. The keel of the Perry was laid April 19, 1899, and she was launched October 27, 1900. The keel of the Preble was laid two days later and she was launched March 2, 1901. The boats are alike in all respects. The complement is 4 officers and 69 men. The principal details are:

Armament.—Two 3-inch guns of 50 calibers; five semi-automatic 6-pounders; two torpedo tubes for long 17.7-inch torpedoes.

Motive power.—Twin-screw, vertical, triple-expansion engines. Thorneycroft water-tube boilers. Designed horsepower of machinery, 7000; speed, 29 knots. Normal coal supply, 25 tons; total capacity not reported.

Dimensions.—Length on load water-line, 245 feet; extreme breadth, 23.6 feet; mean draft, 6.5 feet; maximum draft aft with all coal and stores, 7.56 feet; displacement at normal draft, 420 tons; tons per inch of immersion at normal draft, 9.4.

STOCKTON: TRIAL.—This torpedo boat of 165 tons is completing at the yard of the Wm. R. Trigg Company, Richmond, Virginia; which company is also building the Shubrick and Thornton. The contract for the construction was signed November 16, 1898; contract price, $129,750; time for completion, one year. The keel of the Stockton was laid March 18, 1899, and she was launched in the early part of last year. She is of the same dimensions as the Blakely and De Long, described on a previous page, carries the same armament, and has the same machinery, boilers, coal capacity, etc. Her trial took place in Chesapeake Bay, November 28, 1900, with the following results:

	Revolutions.	Steam at engines.	Vacuum.	Air pressure.
Starboard	*	249.8	23.15	3.0
Port	356.5	247.3	21.30	3.0

*The starboard counter broke down during the trial.

The horsepower developed was about 3400; and the average speed was 25.79 knots. This was below the 26 knots required by the contract, but as the boat was loaded to a displacement of 200 tons instead of the normal of 165, it was regarded as eminently satisfactory. The engines worked well and without undue vibration, but there was considerable vibration of the bulkheads, which caused breaks in the cylinder drain pipes, water-service pipes, and disarranged the starboard revolution counter.

HOLLAND: SURFACE RUN.—On January 8 the Holland started from Annapolis for Norfolk, Va., attended by the tug Standish. She arrived at Norfolk 48 hours and 25 minutes after starting, having stopped once to rest the crew and three times for other causes. The reports of Lieutenant Caldwell, her commanding officer, and of Lieutenant-Commander Edwards, who was on board for the purpose of taking data and making observations of her performance, are published in the *Journal of the American Society of Naval Engineers* for February, 1901; and they are very interesting and instructive, but are too long to insert here in full. The following data are from Lieutenant Caldwell's report:

a. Distance run, 145 knots.
b. Time underway, 25 hours 36 minutes.
(Time at anchor, or stopped, 22 hours, 49 minutes.)
c. Average speed, 5.67 knots.
d. Maximum speed, 7 knots.
e. Consumption of gasoline for propulsion, 125 gallons.
f. Consumption of gasoline for charging battery, 20 gallons.
g. Capacity of gasoline tank, 1300 gallons.
h. Reserve capacity (ballast tanks), 3500 gallons (approximating).
i. Consumption of engine oil, 12 gallons.

The air storage is comprised in three sets of flasks (each of about 12 cubic feet capacity) with air at a pressure of 2100 pounds per square inch. For convenience in comparing supply with consumption, this is referred to as 6300 pounds of air. The compressor can raise the pressure in any one set of flasks about 350 pounds per hour. Using this notation:

k. Amount of air in flasks at beginning of run, 6300 pounds.
l. Air compressed during run, 8850 pounds.
m. Air remaining at end of run, 2600 pounds.
n. Air used during run, 12,500 pounds.
o. Average consumption of air per hour for steering engine and whistle, 488 pounds.
p. Voltage on battery at beginning of run, 126.
q. Voltage at beginning of recharging, January 9, 109.
r. Voltage at end of recharging, 124.
s. Voltage at end of run, 120.
t. Maximum temperature in boat (engine compartment, engine running), 60 degrees Fahrenheit.
u. Minimum temperature in boat, 45 degrees Fahrenheit.
v. Weather, generally fair.
w. Wind, moderate to light southerly breeze.
x. Sea, generally choppy.
y. Draft, 8 feet 6 inches.
z. Condition of bottom, foul.
a. Pitching and rolling, not noticeable.

AMMUNITION.

KRUPP CAPPED PROJECTILES.—Krupp has recently taken out a British patent (Granted October 17, 1900) for a new form of cap. The idea is to provide a cap for a projectile so that capped or uncapped projectiles, which are—except for the cap—of the same weight, can be fired from the same gun without change of elevation or powder charge. It must be remembered, in this connection, that almost every European nation still uses shells of two weights, necessitating two weights of charge to give the same velocity. The shape of Krupp's new cap is very much more pointed than ours and extends much farther beyond the point of the projectile. It would seem to be very ineffective at oblique impact, as it could hardly fail to be detached or broken off on account of its excessive projection beyond the point of the projectile.

JAPANESE HIGH EXPLOSIVE SHELL.—It is reported that Japan has adopted a high explosive, of Japanese invention, for use in all shell up to and including 8-inch caliber.

COMBINATION PRIMERS.—Combination electric and percussion primers are coming into favor abroad if the number of patents taken out is any indication. The Skoda Company, of Pilsen, Bohemia, has brought out one (British patent granted August 1, 1900). In the primer for metallic cases the electric wire passed through a hole in one side of the head, then winds around in a score at the bottom of the thread and enters the primer below the percussion cap. The primer for guns not using fixed ammunition is similarly arranged. The electric wire winds about the primer as before in a helical score cut in the outer surface. The object of combination primers is of course to give a quick change to percussion in case of failure of the electric mechanism. But in a well-fitted and well cared-for electric system the failures need not exceed one in a hundred—and that due to a broken wire in the primer, usually—provided the firing current is of ample voltage. Not less than 10 volts is sure and 12 to 15 is better. With this no grime, dirt, moisture or grease in the primer seat will cause failure in a single wire system.

ARMOR.

Very few armor trials have taken place during the past quarter as winter is not very favorable or convenient for such work. The only two plates tested, so far as the compiler has observed, are those whose trials are described below.

The Japanese are building an armor plant of their own and making preparations to supply most of their wants in the way of ships, guns, and armor. This seems to indicate that they intend to continue the strengthening of their fleet, which has recently had such great accessions.

Messrs. Beardmore & Company are coming rapidly to the front as armor manufacturers and have the only armor factory on the Clyde. They have greatly increased the capacity of the armor department of their Parkhead establishment and are now turning out about 600 tons of armor per month, chiefly for the British navy. Until within a few years, these works have not produced much armor since the days of wrought iron, when they furnished plates for some of the earliest British armorclads.

Sir W. Armstrong, Whitworth & Company, Limited, is now able to

supply armor from its Openshaw Works, Manchester. It is a noticeable fact that within a few years several of the great British armor and gun-makers have developed their facilities until they are now able to produce all the principal essentials of a warship—hull, armor, and guns. Thus, the Vickers Company, beginning with armor, acquired a large ship-building plant and now makes guns. Sir J. Brown & Company, armor makers, have recently purchased the Clydebank shipbuilding yard and probably will soon have a gun factory. The owners of the Parkhead Works—originally a machinery and armor plant—have bought the Govan shipyard, and they too may soon become gun-makers.

Our armor controversy attracted much attention in Europe, where the price of armor was somewhat greater than in the United States, and now is very much greater. In Germany our successful stand for lower prices has brought about a fight against Krupp, hitherto a sort of German demi-god who could do no wrong. A concise statement of the situation from the *Army and Navy Gazette* is given below:

PRICE OF ARMOR IN GERMANY.—Some curious facts have been disclosed in the report of the Budget Committee of the Reichstag on the German Navy estimates, which throw a side light upon what the opponents of the expansive policy of the Government describe as "business patriotism." Before the Navy Bill became law the *Berliner Neueste-Nachrichten* and the *Post*, newspapers which belong to Herr Krupp and Baron von Stumm, were among the foremost advocates of an increase of the German fleet, a fact which did not escape the critics of that measure. The reason of this earnest advocacy now almost seems to be apparent. Herr Krupp and Baron von Stumm possess, or are chiefly interested in, monopolies for the manufacture of armor plates for the Navy, and the price paid to them is 2320 marks per ton, being 400 marks in excess of the price paid for armor in the United States, and the circumstance is the more curious because the American manufacturers pay to Herr Krupp and Mr. Harvey 142 marks per ton for the use of the patents. It is estimated by the Budget Committee that the difference in price means a loss to the German Government of 3,000,000 marks a year, and consequently of 60,000,000 marks before the new fleet can be completed under the Navy Law. The criticism of the Committee is trenchant. "In view of this monstrous extortion on the part of the two firms which have secured a monopoly in the manufacture of these plates, it is thought necessary either to encourage foreign competition or to establish Government works for the manufacture of nickel-steel armor plate. A resolution to this effect has been carried by fifty votes to four."—*Army and Navy Gazette*, March 9.

Just as the NOTES are about to be closed and sent to the printer, I notice in the last foreign mail received that, "The proposal of the German Budget Committee that a State foundry should be established for the production of armor plates has been passed at a plenary sitting."

TRIAL OF A 6-INCH CARNEGIE, KRUPP PROCESS, NICKEL-STEEL PLATE.—The trial took place on February 23, 1901, at the U. S. Naval Proving Ground, Indian Head.

Plate: 6 inches thick; curved turret plate, supported against ordinary backing (not fitted to curve of plate), and representing 250 tons of armor for the Russian battleship Imperator Alexander III.

Rounds 1, 2, and 3. Gun: 6-inch. Velocities, 1910 to 1930 foot-seconds. Projectiles: Midvale-Holtzer; weight 100 pounds. Centers of impact

about equidistant. Line of fire: practically normal to surface of plate. Result on plate: penetration of first shot, 1.7 inches; maximum penetration, 2 inches; no cracks and comparatively little flaking; metal showed fine grain like tool steel. Result on projectiles: broken up into small pieces; those of first rounds, which remained in the plate, were shaken out by subsequent rounds.

This was certainly a very excellent plate, probably never excelled, but its exact merit was not determined, as the test was for acceptance only and not to ascertain its full resisting powers.

TRIAL OF A 6-INCH ARMSTRONG EXPERIMENTAL, SPECIAL PROCESS, NICKEL-STEEL PLATE.—The trial took place February 7, 1901, at the British government proving ground, Whale Island, Portsmouth.

Plate: 6-inch experimental plate; 8 feet by 6 feet; made by Sir W. Armstrong, Whitworth & Co., Limited, at the company's new Openshaw armor factory near Manchester.

Rounds 1, 2, 3, 4, and 5. Gun: 6-inch. Velocities, 1970 to 2016 foot-seconds. Projectiles: English Holtzer. Line of fire: normal to surface of plate. Centers of impact symmetrically placed, four at corners of a square and one in its center. Result on plate: no shots perforated plate; penetration not reported; no cracks. Result on projectiles: broken up.

The merit of the plate is undetermined from the reports. It may be a good plate. But all good 6-inch plates will stop 6-inch projectiles at velocities not exceeding 2200 foot-seconds without cracking and without perforation.

COALING SHIP.

A most excellent article on this subject by Lieutenant-Commander Edwards is published in the February number of the *Journal of the American Society of Naval Engineers*. It is very full and exhaustive, treating of coaling ship under all conditions. Its length and the variety of points treated preclude any satisfactory review of it in these notes. Following it in the same number of the *Journal* is an equally valuable article upon the steaming radius of American ships of war by Lieutenant Bryan, in which is given the radius of action of almost every ship in the navy under various conditions of speed, etc.

RECENT COALING RECORDS OF BRITISH BATTLESHIPS.—The following is clipped from the *Army and Navy Gazette* of February 23, 1901: Last week we chronicled the fact that the Majestic had regained the record for coaling from the Prince George, which had recently captured it. Now we have to note that the Mars has snatched it from the Majestic, her average of tons per hour being 203.8 to the 200.3 of the flagship. The coaling of the five battleships which formed the Portsmouth division of the Channel Squadron was utilized on this occasion by Commander Heathcote, who has just undertaken the control of the depôt to obtain certain data for his guidance in the future. The ships were coaled both from the shore and from lighters alongside, the latter being fitted with Temperley transporters. Of the five vessels the Prince George alone had the disadvantage of three hours of artificial light, and her performance in these circumstances is the more creditable. The following are the particulars of the evolution as carried out on board the five ships:

Ships.	Date.	Tons shipped.	Working hours.	Average tons per hour.
Hannibal	Jan. 14	943	5h. 45m.	170
Prince George....	Jan. 25	1,220	6h. 30m.	187.7
Resolution	Jan. 28	1,215	7h. 10m.	169.5
Majestic	Feb. 4	1,230	5h. 50m.	200.3
Mars	Feb. 6	1,070	5h. 15m.	203.8

COMMUNICATIONS.

NOTE.—Under this head will appear notes on Signaling, Telegraphy, Ocean Cables, Carrier Pigeons, etc.

SUBMARINE SIGNALING.—Mr. Arthur J. Mundy, assisted by the late Professor Elisha Gray, have developed a system of submarine signaling by the use of a submerged bell. Their experiments showed that the sound of a large submerged bell might be heard on a ship at a distance of a mile, provided the observer went down in the hold and listened when as near the skin of the ship as possible. "The sound waves produced by the bell come through the water and penetrate the skin of the ship, diffusing themselves in the atmosphere of the hold, where they are recognized by the unaided ear, just as any local sound might be. The sound is heard more plainly, however, by placing one end of a wooden rod against the skin of the ship and pressing the other against the outer ear. A common tin ear trumpet, such as is used by a deaf person, screwed into the end of a piece of gas pipe and submerged a few feet, the mouth of the trumpet being sealed with a tin diaphragm, will enable the observer at the upper end of the pipe to hear the bell a distance of three miles."

For greater distances, Professor Gray invented an electric submerged receiver, which could be connected up with an ordinary telephone receiver in the pilot house or elsewhere. An 800 pound bell, specially arranged for being struck electrically, was recently experimented with and the results were: "At 1.5 miles the sound of the bell was very loud and very distinct; at 4 miles the sound was quite as distinct and almost as loud as at 1.5 miles; at 8 miles the sound was quite as distinct as at 1.5 miles and almost as loud as at 4 miles; at 12 miles the sound was heard at times quite distinctly, and at times somewhat feebly. Even at 12 miles the sound received was sufficient to give a practicable warning signal. By means of bells and a receiver which will determine the direction of the sound it is proposed to adapt the discovery to giving warning signals of the proximity of dangers to navigation."—From an article by Mr. Mundy in the *Scientific American*. The apparatus, or a modification of it, might also be used for communication between ships.

CONSTRUCTION.

NOTE.—Under this head will appear notes on Design, Materials, Sheathing, etc.

RUSTING OF IRON.—Ordinary red rust is essentially an oxide of iron, containing combined water and practically identical with jewellers' rouge, which is nearly pure ferric oxide, Fe_2O_3. The ordinary chemical explanation of the process is that the iron combines with the oxygen of the air according to the equation

$$2Fe_2 + 3O_2 = 2Fe_2O_3$$

or, taking the combined water into account, according to the equation

$$Fe_2 + 3O + 3H_2O = Fe_2O_3, 3H_2O.$$

That these simple equations do not represent the actual facts of the case has been known for years, as well as the fact that iron placed in contact with an alkali does not rust. To explain this fact it has been suggested that the presence of carbonic acid gas is necessary for rusting to take place, and that the alkalies absorbing this prevent rusting. On this view the phenomenon of rusting according to Professor Crum Brown, takes place in two stages, as follows:

1. $4[Fe + H_2O + CO_2] = 4FeCO_3 + 4H_2$.
2. $4FeCO_3 + CH_2O + O_2 = 2Fe_2(OH)_6 + 4CO_2$.

A close investigation of the matter has, however, led Mr. W. R. Dunston, F. R. S., to question this theory, and to conclude that the presence of CO_2 is by no means necessary for the production of this red rust. Thus, five pieces of bright iron were taken, the first was placed in dry oxygen, the second in water vapor, the third in liquid water, the fourth in a mixture of pure oxygen and water and vapor. In none of these cases was any rust formed. The fifth specimen, however, was placed in liquid water charged with pure oxygen, and the production of rust was then quickly apparent, although no CO_2 was present. In fact, for this rust to be formed it is essential, Mr. Dunstan finds, that the iron shall be in contact with liquid water, and with oxygen. A piece of bright iron placed in a receiver over a dish of water remained perfectly bright for sixty hours, provided that the temperature was kept constant, so as to prevent the condensation of the water on the metal. A similar piece, similarly suspended, but without any precaution against this condensation, soon showed spots of rust. Reasoning on the results of the experiments just described, and on the fact that alkalies prevent the formation of rust, Mr. Dunstan suggests that the real active agent is hydrogen peroxide. To test this, iron was suspended in water, to which were added substances, some of which decompose this peroxide, whilst the others have no such action. In every case the former prevented the production of rust, whilst it always occurred in the latter. In addition to the alkalies, which destroy peroxide, potassium bichromate, potassium ferro-cyanide, and sodium nitrate, were tried. These, whilst destroying the peroxide, are, unlike the alkalies, powerful oxidizing agents, yet nevertheless they proved efficient protectors of the metal. In another experiment a piece of iron was immersed in a solution of hydrogen peroxide, which was made just alkaline. Under these conditions, although the peroxide was decomposed and oxygen was freely liberated at the surface of the metal, the latter did not rust. The whole phenomena of rusting is then, according to Mr. Dunstan, effected by the iron taking up O from the water, forming ferrous oxide, and producing peroxide of hydrogen; the latter then immediately combines the ferrous oxide to form the red rust.—*Engineering*, London.

SHEATHING OF THE U. S. COAST SURVEY STEAMER BACHE.—In answer to a request from Captain C. D. Sigsbee, Chief Intelligence Officer, U. S. N., he has been furnished with fifteen different reports concerning the condition of the steamer Bache, made between May 13, 1889, and April 9, 1899, by Lieutenants J. F. Moser and R. G. Peck, U. S. N.; P. A. Walker, Asst. C. and G. Survey; H. G. Ogden, Insp. Hydry. and Top., a U. S. Local Inspector and a Board of Inspection. Summing up these

reports Chief Constructor Philip Hichborne, U. S. N., Chief of Bureau, says:

"To summarize, it may be stated that this vessel, not originally intended to be sheathed, was, nine years after her launching, fitted with a system of sheathing which involved a neglect of some of the most obvious precautions in such work, and the use of iron bolts; and in the execution of which the workmanship was bad. She served thirteen years continuously without an examination of, or repairs to, her sheathing or sheathing bolts, and is to-day in active service, though nearly thirty years old, with her frames and plates in such a condition through internal corrosion in the machinery and bunker spaces as would have long since compelled her abandonment or extensive rebuilding had she not been sheathed; without the sheathing applied twenty years since having been renewed or the bottom plating sighted or repaired. That these results are possible under such conditions speaks volumes for the possibilities of an efficient system based upon experience (in which every precaution is taken and neutral non-corrosive and brass bolts are employed), executed with scrupulous regard for the highest class of workmanship; in a service where periodical examination and proper care is fully provided for."—*Army and Navy Journal.*

Galvanic Action of Copper Sheathing.—The opponents of copper sheathing for our warships will find strong confirmation of their criticisms in the very ugly discovery that was made the other day on the British cruiser Ariadne, and later on another cruiser, the Spartiate. Copper sheathing was introduced to enable ships to remain at sea for longer periods than is possible when the steel plating of the hull is unprotected. The theory is good, and the practice of it would be equally so were it not for the disadvantage that the galvanic action of copper on other metals in the presence of salt water is liable to be very destructive. As long as the metal bolts which fasten the wood sheathing to the inner steel hull can be kept perfectly water-tight, and the salt water prevented from getting in contact with the steel hull, sheathing is no doubt an excellent device; but experience seems to prove that it is extremely difficult to preclude conditions favorable to galvanic action. In some cases the steel plating has been badly attacked, while in others, the fitting of the sea valves and other outboard connections have been seriously damaged. During the latter part of August, the Ariadne, a new British cruiser of 11,000 tons displacement and 21 knots speed, was found to be leaking rapidly while at her moorings. The leak was of such dimensions that it was assumed that a Kingston valve had inadvertently been left open.

After the vessel had been hurriedly docked, it was ascertained that the corrosion of the bolts, both inside and outside of the ship, had been so extensive that the mounting of one of the underwater fittings had fallen off, allowing a great inrush of water. The corrosion of the outer bolts of the Spartiate, a sister ship, had previously been detected, and on docking the vessel it was found that the inner bolts had also been corroded.—*Scientific American.*

The facts concerning the Ariadne and Spartiate are correct, but the remarks concerning sheathing are only partly true. The causes of rejection of sheathing for our new vessels are not so few nor so definite as here stated. The reasons against sheathing armored ships are more serious than those against sheathing ships without belt armor. First and

foremost is the difficulty of attaching the sheathing to hard-faced armor; secondly, the difficulty and cost of heavy bronze stem and sternposts and trouble of fitting the butts of the sheathing in a secure and strong manner; then there is the extra cost entailed by sheathing; fourthly, possible galvanic action; and lastly, it is not yet proved that sheathing will do all its extreme advocates claim for it. Want of accurate data on this point is to be deplored. People are apt to take violent sides on the question of sheathing with very insufficient reason. The compiler began to collect data on this subject some years ago but the greater part was lost in the wreck of the Charleston. In the United States Navy we have had very little experience with sheathing, but the British and French have had much. Quite half of their large cruisers of recent date are so fitted and, up to the present, but little trouble has been experienced with them. Certainly the accidents to the Ariadne and Spartiate are a new departure and must have had special and unusual causes. Of course a small amount of corrosion is expected and is usually found, but it is ordinarily of little importance. Corrosions due to different causes, but quite as serious in character, are occasionally found in unsheathed ships.

Bilge Keels for Torpedo-Boat Destroyers.—Experiments are to be carried out at Portsmouth to determine whether, and if so to what extent, bilge keels would affect the speed and manœuvring power of torpedo-boat destroyers. A 30-knot vessel is to be selected, and she is to have her decks cleared of torpedo-tubes and other obstructions in order to provide room for 50 men in addition to the crew. The boat is to be run without bilge keels at 15, 20, and 25 knots, and the men are to be so distributed as to produce the maximum of heel consistent with safety while the vessel is underway. The boat is then to be docked and provided with bilge keels, after which precisely the same trials are to be gone through. If it be found that there is no material depreciation of speed and manœuvring power, bilge keels will be supplied to all the destroyers, with a view to improving the steadiness of their gun platforms.—*Engineering*, London.

GUNPOWDER AND EXPLOSIVES.

Erosion of Guns.—The causes of the erosion of guns are not yet all definitely known; but that the principal cause is the chemical action of the powder, promoted by the mechanical action of the projectile, seems to the compiler to be fairly well established. This theory, which has not, so far as observed, been published, is briefly as follows:

In those powders in which there is an excess of oxygen beyond what is barely necessary to turn the carbon of the powder into CO and the hydrogen into H_2O, the erosion is serious; and the amount of erosion is greater as the excess of oxygen is increased. No accounts are at hand of any experiments in which the amount of erosion has been carefully measured and it is therefore impossible to say just how the rate of erosion varies, but that it increases with increase of excess oxygen is clearly evident from various reports of the action of powders of different types. The pure gun-cotton powders have either no excess oxygen, or very little, depending upon their type, while the powders containing nitro-glycerin have a good deal, the amount depending chiefly upon the percentage of that ingredient.

When the powders which are rich in oxygen are exploded, there is liberated sufficient of this gas for forming CO with some additional oxygen. There is also the oxygen of the air enclosed in the gun which is heated to a point at which it will combine with any oxidizable substance. The additional oxygen may—and probably most of it does—at once combine with the CO to form CO_2. But part of it may unite with the surface of the metal of the gun where it has just been rubbed clean by the passing projectile and form Fe_3O_4. If any Fe_2O_3 were to form at the high temperature at which the gases are immediately after explosion, it is likely that it would be immediately reduced to Fe_3O_4. However, the point is unimportant, probably. It is possible, but doubtful, that some H_2O_2 would be formed if the excess of oxygen were very great. If so, it would be immediately reduced by the metal, or by the CO, in the former case accelerating the formation of iron oxide (see notes on Construction—Rusting of Iron). Whatever of iron oxide is formed in front of the seat of the rotating band of the shell (of course after the shell has moved forward) will be swept away by the next shell as it passes through the bore and the process of oxidizing repeated.

In view of the fact that CO will reduce iron oxides at high temperatures, it is possible—probable, even—that the Fe_3O_4 formed on the interior of the bore will be reduced to iron again almost as soon as formed. But the metal which has been oxidized will be left in a soft, spongy state, almost as easily swept away by the band of the projectile as if were still oxidized. This brushing away of the surface of the bore would produce exactly such effects as are complained of in guns using cordite, ballistite, and other nitro-glycerin powders. The top of the land wears faster than the bottom of the groove, as the pressure is greater upon it, though of course the metal in the groove is also worn to some extent. The action of the nitrogen is not taken into account, as this inert gas is not liable to oxidize in the presence of uncombined carbon, hydrogen, and iron; indeed, the high temperature and shock of firing might quite as likely result in the production of a small amount of ammonia as of a nitrogen oxide.

Erosive Effects of U. S. Navy Smokeless Powder.—At Indian Head, according to the report of the Chief of Bureau of Ordnance, four-inch gun No. 212 has been fired 661 times and five-inch gun No. 133, 666 times, with the navy smokeless powder without causing enough erosion or wear to be measured with the instruments in use at the proving ground.

Navy Smokeless Powder: Keeping Qualities; Ignition Powder.—Samples of 5-inch powder, which had been in the magazine of the Marblehead for two years, were tested at Indian Head, and there was not the least deterioration in ballistic qualities nor sign of chemical change. Another sample, kept in the magazine for one year, showed equally good results. So far no smokeless ignition powder has been found that gives acceptable results. Great variations in pressure have resulted from attempts to use a smokeless ignition charge in place of one of black powder. This variation is almost always in the nature of an increase of pressure; and this is generally 25 per cent, sometimes reaching 50.

Pure Nitro-Cellulose Powders: Regular Velocities.—Those powders which are made of pure nitro-cellulose, all of the same formula—in other words pure chemical compounds before colloiding—should in theory give more regular velocities than powders made up of several

sorts of nitro-cellulose, or of nitro-cellulose and nitro-glycerin. It is known that cordite and ballistite at different temperatures give velocities differing as much as two and a half per cent and that other causes than temperature affect their velocity appreciably. Lieutenant Dawson, late of the British navy, but now one of the artillery engineers of the Armstrong Company, states that in a pure nitro-cellulose powder is apparently our only hope for getting very high and regular velocities.

BALLISTITE: DETERIORATION.—A dispatch from Rome to the New York *Sun*, dated March 16, 1901, says:—"Several million cartridges charged with ballistite, a new explosive to which the Italian military authorities have pinned their faith, were recently found in a damaged condition, and the Italian Minister of War immediately ordered a special inquiry into the affair.

"It is now announced that the inquiry demonstrated the fact that ballistite deteriorates after a certain period, the actual length of which has not been made known. The committee recommended the adoption of a more reliable explosive.

"Meantime, of course, ballistite must be retained. But the fact that a large proportion of the cartridges now in store are steadily becoming unfit for use causes alarm. The present stock aggregates 200,000,000 cartridges." Ballistite is a first cousin to cordite. Its erosive effects have been heard of frequently but this is the first report of deterioration. It is composed of nitro-glycerin, nitro-cellulose, and camphor formed into a colloid. The proportion of its ingredients vary within small limits to adapt the powder to different uses; but the patent specifications of its inventor, Mr. Alfred Nobel, describes the manufacture as follows: "Dissolve 10 parts by weight of camphor in 100 parts of nitro-glycerin, and then add 200 parts of benzole. Carefully steep 50 parts of dry nitro-cotton pulp in this mixture and then evaporate the benzole. Then mix thoroughly by passing between steam-heated rollers. When this mass becomes homogeneous, roll out into sheets, and finally cut up into grains or mould into any desired shape."

FOSSANO POWDER WORKS: TO BE REBUILT.—It is reported that the Italian government proposes to rebuild the great powder works at Fossano which, since the advent of smokeless powder, have been almost entirely abandoned. The renovated works will be fitted with new and extensive plant for the manufacture of smokeless powder and of ordnance supplies.

LYDDITE: POOR WORK IN SOUTH AFRICA.—Referring to lyddite, a writer in the *Times* remarks that this explosive has failed to give satisfaction in South Africa, very few of the shells detonating satisfactorily. This, he states, is due to the peculiar nature of the substance, which is unsuitable for use in shells of less than 100 lbs. weight, and if bigger, so much the better. The fact that the shells used are reported to have given rise on bursting to greenish-yellow fumes is itself evidence that proper detonation had not been attained, since in that case the smoke is black. The difficulty is not a question of fuse or primer, but is inherent in the nature of the explosive, which in larger shells gives every satisfaction.—*Engineering*, London.

MAXIMITE: TRIAL.—In the London *Engineer* appears the following note in regard to a recent trial of this explosive: "Maximite, a high explosive invented by Mr. Hudson Maxim, was tested at Sandy Hook recently. According to accounts, a 1000-lb. 12-inch shell was filled with

70 lbs. of Maximite and fired through a 7-inch plate without explosion. thus making it equal to wet compressed gun-cotton in this respect. By exploding the Maximite a 12-inch shell was broken into about 10,000 fragments." The report does not state how the shell was exploded. The question is: Can Maximite be fired through armor *and exploded on the other side?* That's where the hitch is with gun-cotton. It will go through the armor all right, but the fuze or other means to cause certain explosion on the other side is yet to be invented.

NEW JAPANESE EXPLOSIVE.—This has been already referred to in the notes under the head of AMMUNITION. It is intended for the bursting charges of shells and probably has a picrate base.

CAUSE OF INSTABILITY OF NITRO-COTTON.—A very interesting and complete investigation into the nature of commercial gun-cotton has led Messrs. A. Luck and C. F. Cross to the conclusion that the main cause of the instability of the cellulose nitrates is not to be found in traces of the nitrating acids still remaining in the finished product, since this can only happen when the manufacture is carried on in a careless manner. They attribute this instability rather to the presence of certain peculiar cellulose derivatives which they find to be produced under even the most careful conditions of manufacture. These compounds are in intimate association with the nitrated cellulose, and cannot be removed by washing with either hot or cold water, or by digestion in cold solutions of soda, or by dissolution in ether, alcohol, or benzine. On the other hand, the compounds referred to are very soluble in acetone and certain other solvents, even when these are so diluted with water as to have little or no action on the cellulose nitrates themselves. By treating the nitrate cottons in this manner, the experimenters state they have prepared structureless gun-cotton of quite an exceptional character, obtaining it in the form of a very fine dense white powder of great purity and stability and entirely free from all mechanical impurities. This powder can be compressed into large masses for military purposes.—*Engineering*, London.

GUNS.

In these notes the use of the term Rapid-fire Gun is avoided as far as possible. The reason is that the term no longer expresses anything. It once could be defined as a gun with rapid working—almost instantaneous—breech action, using fixed ammunition. It is now used indiscriminately to express guns using fixed ammunition; or ammunition in which the charge and projectile are separate, but the charge in a metallic case; or ammunition in which the charge is put up in bag or envelope of combustible material and fired by a separate primer. The breech mechanism of all guns up to eight-inch caliber is now operated by a straight pull level action. In the higher natures Krupp claims the term R. F. for his 9.4-inch and 11.02-inch guns. Guns of exceptionally speedy operation will be referred to as rapid-firing, or rapid-loading guns.

RAPID LOADING OF GUNS.—It seems probable that within a very short time more efficient methods of loading heavy naval guns will be adopted. Krupp has led the way in his new 9.4-inch and 11.02-inch pieces. A description of his methods has not yet appeared, but the direction in which we are to look for improvement seems well defined. The breech must be opened and closed automatically and rapidly. The projectile and

powder charge must be loaded at one operation and the present system of bringing up the ammunition in several parallel cylinders done away with. To achieve this satisfactorily a little more room will probably have to be made in rear of the guns. But if the gain is such that we can load a 12-inch gun in twenty seconds, it is surely worth the expense. Our 8-inch turrets are all too small for rapid work. A slight increase of size would double the rate of fire by giving sufficient room to handle the ammunition easily.

CALIBERS OF GUNS.—The improvement of armor is at last bringing about the displacement of the 6-inch gun from its commanding position as the principal auxiliary gun of European battleships. For a time we, most unwisely I think, dropped the 8-inch gun from our battleship batteries, following European practice. Now we have reinstated it at a time when almost all Europe is considering about adopting a heavier gun than the 6-inch for the principal auxiliary piece. Italy has frankly thrown the 6-inch aside and adopted the 8-inch for both armored cruisers and battleships. The British are about to introduce a 7.5-inch piece, and there are rumors that the new German battleships will carry 8-inch guns in place of 6-inch. The mixed battery of our battleships could, I think, have been improved by doing away with the 6-inch caliber altogether. To keep our lead in construction we should adopt a battleship of 16,000 tons and 21 knots speed, carrying four 12-inch guns, sixteen 8-inch guns, and thirty-two 3-inch. This seems a very heavy battery. But it is not so difficult to instal as might be supposed. Let us start with a ship like one of our battleships of the Georgia class as originally designed with four 8-inch turrets on the main deck. Below and between these, resting in a recess cut in the upper works, instal another 8-inch turret; and superpose a turret on each 12-inch. That gives the sixteen 8-inch. Since the ship will be about 450 feet long she will carry seven 3-inch each side on the gun deck forward of the 8-inch turrets and five each side abaft them; three each side on the forward bridge deck, and one each side on the after one.

NEW 11.02-INCH KRUPP GUN.—Herr Krupp has announced the development of a 28-centimeter rapid-firing gun. It is stated that this piece will be mounted in the new German battleships instead of the 9.4-inch gun.

VICKERS-MAXIM GUNS.—In connection with letters which have recently appeared in the *Times* under the heading of "Our New Service Guns," commenting on certain details of design, the *Times* of the 15th inst. states that in the case of the 6-inch Vickers gun over 500 rounds were fired to test the mechanism and the general working of the system, with the result that large numbers of these guns have now passed into the service and have given excellent results after extended use. In the case of the 6-inch gun, too, a rate of fire of 11 rounds per minute has been obtained during trials, developing energies nearly 100 per cent greater than those in the preceding service weapon of this caliber. The heavier calibers of guns were also proved to be satisfactory after adequate tests under service conditions. Messrs. Vickers, Sons, and Maxim, Limited, have received instructions from the Japanese Government for the supply of three different types of guns having the same mechanisms as those now in use by the British government. The guns are to be shipped to Japan at the earliest possible time, and their special feature is that they are to be capable of developing very high energies. The guns consist of (1) a 6-inch gun having a velocity of 3000 foot-seconds, and

firing at a minimum rate of from eight to ten aimed rounds per minute under service conditions, as is the case with the existing British service guns now being installed in our new ships and fortresses; (2) a 12-pounder ship gun of 50 calibers, having a velocity of 3000 ft. and a rate of fire not less than 15 rounds per minute; (3) a 12½-pounder landing gun of very light construction, carrying 50 per cent more ammunition than is usually the case with our British service guns, and being capable of dealing with ranges up to 7000 yards. The same company is also supplying to the Spanish government a 14-centimeter gun of nearly the same power as the 6-inch gun now used by the British government, the details of construction of the mechanism being practically similar. They are also making a 6-inch gun for the United States Army,having a velocity of 2850 feet, with their special type of De Bange obturator quick-firing mechanism, similar to that adopted by the United States Navy about two years ago, when the government acquired from Messrs. Vickers the manufacturing rights of the mechanism for the Navy on payment of a quarter of million dollars. In addition to this Messrs. Vickers are adapting their heavy mechanism to a 24-centimeter Austrian gun, which is to be taken under trial by that government in February next. Such a general application of this type of mechanism to foreign ordnance is gratifying at a time when the enterprise of British manufacturers is a matter of criticism.—*Engineering*, London.

Sighting Guns for British Turrets.—According to the *Westminster Gazette*, the Admiralty have decided that all sighting guns for turrets and barbettes are to be replaced by three-pounder quick-firing guns. These sighting guns are mounted on the tops of turrets and barbettes, and as they are controlled by the training and elevating mechanism of the larger guns, they prove most useful for instructional purposes, besides enabling captains of guns to ascertain the exact line and elevation for the larger armament in action, thus saving a large amount of ammunition, time, and labor.—*Engineer*, London.

Of course the day has passed away when the range could be determined in action by the fall of small caliber projectiles, except under unusual circumstances; and this last comment was doubtless added by some uninformed critic belonging to the press. But for the purposes of sub-caliber practice this arrangement is a good one and would enable the drill at the gun to take place at the same time as the target practice, and this would further simulate the conditions of battle. Besides, the placing of sub-caliber guns inside larger ones is objectionable for many reasons.

GUNS: FIRING.

Note.—Under this head will be given notes referring to firing tests of guns, target practice, special practice, accidents to guns while firing, etc.

Accident to Kearsarge's 13-inch Gun.—A projectile recently exploded in one of the Kearsarge's 13-inch guns and injured the rifling to such an extent that it is considered advisable to have the gun relined.

Gun Accident on the Thunderer.—While the battleship Thunderer was on her way from Pembroke dock to Devonport on Thursday, an accident occurred to her two turret guns, the cause of which is so far unexplained. The vessel left Pembroke about nine a. m., and when off Milford a target was put out for firing practice, the 10-inch breech-loading

turret guns being used. A projectile had been placed in one of the guns and the electric contact made, when there was an explosion quite different from that which usually accompanies the discharge of a projectile. Nothing came out of the gun except a few fragments of the projectile, which were thrown some distance from the ship. The base plate of the projectile was left in the gun, as well as a portion of the frame, and when the plate was afterwards removed, it is reported that the pressure of the gas left in the gun caused a portion of the projectile to be expelled with some force from the breech end of the gun. How such a thing could happen is by no means evident. On the second gun being fired, says the *Western Morning News*, a complete hole, between 2 inches and 3 inches in diameter, was blown through the projectile, the outer part, together with the base plate, being left in the gun. In this case, however, the base plate was separated from the rest of the projectile. Such a thing is believed never to have occurred on any ship before. The only explanation so far suggested is either that the powder in the projectile was damp or that there was a quantity of water in the guns. A cast will be made of the inside of each gun to ascertain whether either has been damaged. So far as can be seen from the outside both guns are sound.—*Engineer*, London, Nov. 9, 1900.

GUN ACCIDENT AT SANDY HOOK.—While testing smokeless powder in a ten-inch B. L. rifle at Sandy Hook on March 7 an explosion occurred and some damage was done to adjacent buildings. It seems that the breech block of the gun was not completely closed when the gun was fired and it blew out, thus causing what has been erroneously termed an explosion. No one was injured and no blame has been attached to any one for the occurrence. It is one of those unusual happenings which occur at the tests from time to time. The War Department has been informed that a six-inch gun while being fired at Fort Wadsworth on March 11 was thrown from its carriage, but with no damage to anything or any one. The cause of the upsetting of the gun is not known in Washington.—*Army and Navy Journal.*

BREECH PLUG BLOWN OUT OF ITALIAN 5.9-INCH GUN, ARMSTRONG MODEL.—The following letter appeared in *Engineering* (London), March 1, 1901:

SIR.—I have been able to gather the following particulars, which I beg to put before you, as they may prove of interest to your readers:

On the 24th ult. gunnery practice was being carried out with a quick-firing 149-millimeter (5.9-inch) A. gun, Armstrong type, on board the gunnery ship Terribile, in the Spezia roadstead. At the firing of one round the breech-block was blown off and the cartridge-case driven to the rear, killing four gunners on the spot, four others being severely burnt by the escaping gas. This gun had been built at the Royal Arsenal of San Vito, Spezia, on plans supplied by Elswick; it is on the type proposed by Elswick in 1889 to the Royal Italian Navy, both for the 120-millimeter (4.7-inch) and 149-millimeter (5.9-inch) guns, and which was adopted by the Italian Admiralty.

In 1890 a very similar accident occurred in the same roadstead to a 120-millimeter (4.7-inch) gun of the same type. The breech-block was blown off into the sea and could not be recovered; the steel was found to be partly torn in one of the threaded parts of the breech-block seating. After this first accident Messrs. Armstrong decided to alter the threads of their 120-millimeter (4.7-inch) gun breech-blocks.

Have we any guns of this type in the British Service? If so, the sooner they are found obsolete by the responsible authorities and replaced by improved weapons, the better it will be.

I am, Sir, yours faithfully,

February 22, 1901. VERAX.

GUN MOUNTS.

TRIAL OF NEW ARMSTRONG MOUNT FOR 9.2-INCH GUN.—A trial was carried out at Portsmouth at the 21st inst. on board the experimental vessel Drudge, of the mark V. mounting, designed by Sir W. G. Armstrong, Mitchell & Co., for the 9.2-inch guns to be mounted in ships of the Cressy and Drake classes. The weight of the gun is 28 tons, it is mounted on a cradle, recoils in the line of fire, and is automatically returned to the firing position by means of springs placed beneath the cradle. This is the usual principle of the Elswick quick-firing mounting so generally in use; but the present 28-ton guns are the heaviest to which this method has been applied in Her Majesty's service. The automatic sighting arrangement is worked by means of gearing from the cradle. The projectiles are lifted by means of a hydraulic cylinder from a revolving shell carrier, which is travelled by hand gear round the gun-house. They are then transferred to a revolving shell tray fixed to the cradle, from which they can be rapidly swung into the gun. The projectiles are raised from the shell room by two hydraulic hoists and transferred to the revolving shell carried in the gun-house. The turntable is locked while this operation is being carried out. The mounting is trained by means of a hydraulic engine connected by a toothed pinion wheel to the training rack. The gun is elevated and depressed by a hydraulic cylinder placed beneath the cradle and connected to it by link gear. The cordite charge is supplied to the gun by two cages, alternately ascending and descending in an axial hoist placed in the center of the mounting. These cages are worked by a hand winch in the handling room. The cages are balanced, and only the weight of the charge has to be lifted, so that a very rapid supply can be maintained. The trial was conducted by Captain W. H. May, commanding the Excellent gunnery school, and was attended by Captain T. B. S. Adair, representing the Ordnance Committee, and Com. G. P. W. Hope, representing the Naval Ordnance Department. More than half a gale was blowing, but the wind cleared the atmosphere, and the full program was carried out. This consisted of one round of a half charge at the horizontal, followed by a three-quarters and full charge in the same position. Full charges were then fired at 4 deg., 7½ deg., and 15 deg. of elevation. It was arranged to fire a full charge at 7 deg. of depression, but owing to the heavy lop there was on the water the depression was reduced to 5 deg. Ten rounds were next fired in rapid succession with full charges and at various degrees of elevation at the rate of a fraction under three rounds a minute. The recoil was then shortened up by using only 85 per cent of the valve key in order to bring a greater strain on the mounting, and one reduced and three full charges were successfully fired with the gun at the horizontal.—*Engineering*, London, Dec. 28, 1900.

INSTRUMENTS USED IN ACTION.

NOTE.—Under this head will be given notes on searchlights, range-finders, stadimeters, torpedo directors, etc.

SEARCHLIGHTS.—In the minds of many people the searchlight is an auxiliary of doubtful importance—more likely to betray than to defend. And evidently in the minds of many designers of ships its rôle is uncertain. The French seem to have no doubt of its importance or how to make it useful without hindrance to the effective work of the battery. They are earnest advocates of the torpedo boat and they have studied and practiced torpedo attack and torpedo defense as no other navy has. Compare their instalment of searchlights with the British or our own. They put what may be called "finding" searchlights close to the water where they will light up a narrow strip of water of great length instead of a small area. The "finders," sweeping the surrounding water, will let no guilty foe escape. The "firing" light holds brightly from aloft on the discovered enemy in a way to give the best definition of the object without blinding the gun-firers. In the new ships and in some others, the lights are placed on the stern walk, one each side; on the main deck, in ports near the stem, one each side; and in the tops. By placing the "finders" near the extremities of the ship, at a distance from the guns, they will disturb the aim of the gunners very little. Any one who has tried, on a dark night, with highly placed searchlights, to find a real enemy who was supposed to be bent on making an attack, will appreciate the advantages of the French system. And those who have seen how difficult it is, with our lights as at present installed, to pick up boats during sham attacks will perhaps realize it equally. Another point, not commonly regarded as of much importance, is the place of operation. It must be remembered that a person operating a light from directly in rear will see with great difficulty objects that are within the sphere of illumination—and other objects not at all. He should be below, above, or at one side, and at a distance of not less than 10 feet if practicable. If at one side, he should keep well in rear or have a shield of good size between him and the light. This, of course, means electric or mechanical control, and I think it is indispensable to good work with the light. I believe that simple hydraulic control through flexible tubes leading to the control station would be best. The pressure in the system need be very small, only sufficient to prevent lost motion, and would be balanced at the operating levers.

SMALL ARMS.

NEW GERMAN RIFLE, M. 87-97.—The arm is of the same caliber as the old one, takes the same cartridge, and has about the same ballistic powers. The velocity of the bullet at 25 meters from the muzzle is 620 meters (2034 feet). The barrel cover has been discarded and the piece more strongly secured to the stock. The sight leaf is pivoted at the forward end and notched at the rear end, the notch following the curve over the end and top of the rear end of the leaf. The leaf has grooves in the sides and in these grooves travel the lugs of a U-shaped slide which has a pointer touching the range scale below. The magazine holds five cartridges. They are not placed one above the other, but are staggered,

three on the right side and two on the left. This makes the lower edge of the magazine come flush with the wood of the stock and barrel casing. The cartridges are put up in the new Mauser loading strip, or clip, which simply holds the heads and is very light. The clip containing the cartridges is placed in the breech and then a pressure on the top cartridge easily forces all into the magazine and the clip, which projects nearly its whole length, is drawn out. The stock has a pistol grip and extends as a barrel casing, but underneath the barrel only, within four inches of the muzzle. The most noticeable feature of the new weapon is the bayonet which is 25.8 inches long and has a slender 20-inch blade. For infantry and chasseurs the back of the blade is serrated in the form of saw teeth. It is not attached to the barrel but to the fore end of the stock and merely rests against the barrel. The principal weights, etc., are: Weight of gun, 9.04 pounds; length, without bayonet, 49.2 inches. Length of bayonet with scabbard, 26.9 inches; weight with scabbard, 1.28 pounds; length without scabbard, 25.8 inches; weight without scabbard, 0.95 pounds. Weight of clip, 108 grains. Weight of cartridge, 429 grains; length, 3.25 inches. Weight of powder, 41.2 grains. Weight of bullet, 227.1 grains; length, 1.23 inches. Weight of clip with 5 cartridges, 5.16 ounces. Weight of box with three filled clips, 1.04 pounds. Belt containing 15 boxes (225 cartridges), 16.3 pounds.

TORPEDOES.

VARICAS TORPEDO; STEERED BY WIRELESS CURRENT.—A very full description of this torpedo and the experiments made with it appeared in the *Scientific American* of February 16, 1901. The system is the invention of a young English electrician, Mr. Cecil Varicas, and the success so far attained is quite remarkable. The torpedo is similar to the Whitehead, but in place of the Obry steering device it has the apparatus of Mr. Varicas, which consists of a Marconi coherer in circuit with a relay and battery. The relay closes the circuit of a decoherer and electro-magnet which attracts an armature. The latter is made to actuate the valve of a steering engine which is connected to the torpedo's rudder.

The stationary apparatus upon the shore, battleship, or other point from which the torpedo is fired, comprises a periodic interrupter placed in circuit with an induction coil, which in turn works a wireless telegraphic transmitter. When this periodic interrupter makes circuit the coil works the transmitter so that ether waves are produced, and the coherer in the torpedo conducts, working the relay which closes the circuit of both the decoherer and electro-magnet. This causes the valve of the steering engine to move, so that the rudder is also turned in a certain direction.

When the interrupter breaks circuit the ether waves cease, and the coherer is decohered by the decoherer and ceases to conduct—the same as is now done in the Marconi system of wireless telegraphy—causing the relay to break the circuit of the electro-magnet on the steering engine, so that it releases its armature. The rudder is then reversed to the opposite direction by a strong spring. By this it will be seen that so long as the interrupter on shore makes circuit the rudder is pointed in a certain direction, but directly the circuit is broken the rudder assumes the diametrically opposite position.

From this it will be recognized that if the alternate making and breaking of circuits is continued with regularity, answered by corresponding regular deviations of the rudder, the craft must travel in a direct straight line. On the other hand, if either the making of the circuit is longer than the period of breaking, or vice versa, the rudder is maintained in one position for a longer period, so that the path traveled is a curve.

In the trials the torpedo was made to go in a straight line to a distant point, or on a curve; to describe circles, lemniscatas, and all sorts of curves at will. The apparatus so far used is only sufficient to control the torpedo up to a distance of 200 yards, but it is said that this distance can be almost indefinitely increased by improving the sensitiveness of the instruments and strengthening the current used.

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ANNUAL REPORT OF THE SECRETARY AND TREASURER OF THE U. S. NAVAL INSTITUTE.

To the Officers and Members of the Institute:

Gentlemen:—I have the honor to submit the following report for the year ending December 31, 1900:

Itemized Cash Statement.

Receipts During the Year 1900.

Items.	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Totals.
Dues	$974 06	$591 66	$166 10	$160 50	$1892 32
Subscriptions	182 69	219 35	152 35	175 03	729 42
Sales	69 78	48 88	56 05	98 13	272 84
Interest on bonds and deposits	45 50	139 21	45 50	18 00	248 21
Advertisements	297 25	232 50	20 00	489 50	1039 25
Binding	6 00	13 80	..	3 00	22 80
Credit on sales	35	..	..	..	35
Premium on money orders	..	04	07	..	11
Life membership fees	..	..	27 00	30 00	57 00
Totals	$1575 63	$1245 44	$467 07	$974 16	$4262 30
Receipts from extra publications					1503 65
Total					$5765 95

EXPENDITURES DURING THE YEAR 1900.

Items.	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Totals.
Printing and binding....	$644 58	$889 49	..	$376 72	$1910 79
Salaries.....	300 00	300 00	$300 00	300 00	1200 00
Postage.....	76 28	39 07	37 65	38 25	191 25
Expressage	14 93	3 03	4 38	4 06	26 40
Telegrams	25	25	25	3 54	4 29
Cost of articles.....	157 00	75 00	25 00	25 00	282 00
Freight and hauling.....	3 96	7 19	3 67	3 31	18 13
Discount on checks.....	1 59	2 02	1 04	96	5 61
Purchase of back numbers	3 50	..	2 80	..	6 30
Prize essay.....	100 00	..	..	..	100 00
" " medal.....	24 10	..	..	..	24 10
Rebate.....	18 00	..	..	..	18 00
Stationery	..	2 15	43 17	11 78	57 10
Repairing typewriter.....	..	11 45	..	..	11 45
Rent for safe box.....	..	5 00	..	..	5 00
Purchase 1 Infantry and Art.....	..	1 15	..	..	1 15
Insurance.....	..	..	28 00	..	28 00
Purchase of text-books...	..	..	..	24 79	24 79
Office expense	..	..	..	20	20
Totals.....	$1344 19	$1335 80	$445 96	$788 61	$3914 56
Paid for printing and binding extra publications					2919 91
Total.....					$6834 47

A liability for extra publications amounting to $2,514.00 is included in the expenditures, which was paid during the year.

SUMMARY.

Balance of cash unexpended January 1, 1900	$4782 03
Total receipts for 1900	5765 95
Total available cash, 1900.....	$10547 98
Total expenditures, 1900	6834 47
Cash unexpended January 1, 1901	$3713 51
Held to credit of reserve fund.....	299 14
True balance January 1, 1901	$3414 37
Bills receivable for 1900.....	994 60
" " " back dues	798 00
" " " binding	20 00
" " " subscriptions.....	56 00
" " " sales.....	2 55
" " " advertisements	349 25
" " " sale of other publications.....	68 01
Value of back numbers, estimated.....	875 00
" " Institute property.....	100 00
" " extra publications.....	2410 00
Total assets exclusive of reserve fund.....	$9067 78

RESERVE FUND.

United States 4 per cent consols, registered	$900 00
District of Columbia 3.65 per cent registered bonds	2000 00
District of Columbia coupon bonds	650 00
	$3550 00
Cash in bank uninvested	299 14
Total	$3849 14
Number of paper-bound copies of the PROCEEDINGS on hand at the end of the year	9308
Number of cloth-bound copies	1494
Total number of copies on hand	10802

Very respectfully,

E. W. EBERLE, *Lieutenant, U. S. Navy,*

Secretary and Treasurer.

OFFICERS OF THE INSTITUTE.

President.

REAR-ADMIRAL WILLIAM T. SAMPSON, U. S. NAVY.

Vice-President.

COMMANDER RICHARD WAINWRIGHT, U. S. NAVY.

Secretary and Treasurer.

LIEUTENANT E. W. EBERLE, U. S. Navy.

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Lieutenant L. S. VAN DUZER, U. S. Navy.
Lieutenant E. W. EBERLE, U. S. Navy (ex officio).
Professor N. M. TERRY, A. M., Ph. D.

SPECIAL NOTICE.

NAVAL INSTITUTE PRIZE ESSAY, 1901.

A prize of one hundred dollars, with a gold medal, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1902. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. Any essay not having received honorable mention, may be published also, at the discretion of the Board of Control, but only with the consent of the author.

5. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

6. All essays submitted must be either type-written or copied in a clear and legible hand.

7. The successful competitor will be made a Life Member of the Institute. If the essayist second in order of merit receive "Honorable Mention," he will also be made a life member.

8. In the event of the Prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of a gold medal.

By direction of the Board of Control.

E. W. EBERLE,
Lieut., U. S. N., Secretary and Treasurer.

ANNAPOLIS, MD., *June 1, 1900.*

Vol. XXVII., No. 2. June, 1901. Whole No. 98.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SOME POINTS IN COAST-DEFENCE BROUGHT OUT BY THE WAR WITH SPAIN.*

By CAPTAIN CASPAR F. GOODRICH, United States Navy.

The events of our late struggle with Spain have been so completely described and analyzed by experts in naval and military science, by eye-witnesses and active participants, by journalists and historians, that further reference to them or to the lessons they convey can be made only after ample apologies on the part of the lecturer, and by kind permission of an audience whose patience is, doubtless, already strained to the point of rupture. It is with frank recognition of the disadvantages and embarrassment of my position that I venture to allude to certain aspects of that war which are calculated to yield to our consideration a large measure of confirmation of the stand heretofore assumed in our studies of coast-defence, as well as of encouragement as to our future immunity from attack.

It would be a presumptuous labor of supererogation to attempt to deal with the general strategy of that brief campaign, so well

*A lecture delivered at the Naval War College, August, 1900.

and so thoroughly has this been done by Captain Mahan, whose volume, entitled "Lessons of the War with Spain," should be attentively conned by naval officers. From the reading of this able and pithy work we gather, among other things, a fresh picture of the state of the public mind during hostilities, which is in striking accord with what was predicted in this very lecture-room two years before the war broke out. Captain Mahan says (p. 67): "The preposterous and humiliating terrors of the past months, that a hostile fleet would waste coal and ammunition in shelling villagers and bathers on a beach, we may hope will not recur." Captain Mahan's hope will not be realized. The phenomenon will assuredly reappear whenever war is declared, just as it has invariably appeared in the past, for it is based upon the immutable processes of human nature. Its pernicious influence on the conduct of a campaign may be somewhat lessened through educating the people to a right conception of the ends sought in a military and naval conflict, and may be entirely overcome, if not dispelled, by stout resistance on the part of the administration.

Again he writes (p. 89): "'Our seacoast,' said a person then in authority to the present writer, 'was in a condition of unreasoning panic, and fought to have little squadrons scattered along it everywhere, according to the theory of defence always favored by stupid terror.' The 'stupidity,' by all military experience, was absolute, unqualified; but the Navy Department succeeded in withstanding the 'terror'—the moral effect—so far as to compromise in the Flying Squadron; a rational solution, though not unimpeachable."

In a lecture on "Naval Raids," delivered at the War College in 1896 and published in the PROCEEDINGS OF THE NAVAL INSTITUTE for June, 1898, the following expressions were employed in reference to the letters and telegrams received by the Navy Department in 1861, 1862 and 1863, containing, urgent if not frantic, appeals for ships to be stationed at various northern ports:

"It is impossible," this lecturer states, "in reading the letters and telegrams quoted above, not to admire the wisdom and firmness displayed by the Secretary of the Navy. A weaker man could not have withstood the popular clamor arising in every seaboard town for local protection, but would have divided our

too scanty forces and have made the less important points secure at the sacrifice of the larger, the vital interests at stake. Mr. Welles' contention was, in effect, that the harbors of New York and Boston were guarded by the blockading fleet that stretched from Cape Henry to the Rio Grande, a surprisingly broad and sound strategic view, from which he appears never to have wavered. This view, the very essence of correct coast-defence, stood successfully the test of years of war. Given fresh conditions not too unlike the old, it will still prevail. Yet, to-day we have on all sides a noisy demand for harbor-defence vessels and batteries of 16-inch guns on every salient."

"Whether, in the event of war in these days, a Secretary of the Navy can possibly be as independent in his action as was Mr. Welles, it is difficult to say. The question is of great importance to us, although it hangs rather upon the sociological development of the country than upon naval policy. Personally, I am disposed to fear that the powers of the press and the politician will, together, overbear the Secretary and force him into abandoning, not the true faith itself, but its practice. It is incumbent upon all who seriously discuss the naval problems of the future to recognize the possibilities for evil which may, and doubtless will, flow from the source so clearly defined in these extracts from the history of the past."

Captain Mahan attributes to a lack of coast-defences, meaning, presumably, harbor-defences, a faulty disposition of our naval strength at the outset. This is what he says (p. 53): "The unsatisfactory condition of the coast-defences, whereby the navy lost the support of its complementary factor in the scheme of national sea power, imposed a vicious, though inevitable, change in the initial campaign, which should have been directed in full force against the coast of Cuba." Possibly, Captain Mahan had confidential information on the subject not accessible to the general public, but the open records do not describe so backward a state of affairs.

It will be my endeavor in the following remarks to show that our brethren in the army had not been behind hand in their labors, and that our harbor-defences, although not developed to the vast extent recommended by the Endicott Board at a time when we had practically no navy at all, were entirely adequate to the task of deterring the Spaniards from attacking any point

worthy of strategic consideration or tactical effort. That a dread approaching panic existed along our seaboard was notorious at the time and is notorious now, but that it was justified by any lack of readiness or power on the part of either the army or the navy, I am not prepared to admit. We were fairly ready, in both services, and Spain knew it. This is the reason, and the inference is a fair one, why, in studying prospective hostilities with the United States, Spanish writers said never a word about carrying the war into America, and why Cervera, conceded to be the most thoughtful and accomplished of his cloth in Spain, and Concas, his able chief of staff, are not known to have examined into even the possibility of such a movement; certainly, they never counselled it.

Says Wilson, in his "Downfall of Spain" (p. 88):

"It will be observed that both these officers are for the virtual abandonment of Cuba and for a policy of complete inaction. Neither as much as suggests raids against the American coast-line. . . . It is strange that neither mentions the bombardment panic which was at this time very prevalent on the seaboard of the United States, or considers that if public opinion would recall the Spanish squadron, did an American fleet appear off the Spanish coast, it might equally well be expected to compel the recall of the American fleet, did the Spanish squadron appear off the coast of the United States."

How could they, when the Report of the Chief of Engineers of the United States Army for 1897 was at their disposal, with its calm and impressive statements of what had been done up to June 30 of that year, what it was expected to finish by December 31, 1897, and what further works were projected or under construction? Naturally, these statements were general rather than specific, and were, properly, so guarded in their phraseology that exact locations and gun commands were not revealed. Still, they could not fail to give a solemn warning to any possible enemy that, at every important seaport, very dangerous modern weapons were mounted, in addition to old guns in masonry works and to the planted mines, which might reasonably be assumed to play an active part in the general military defence.

As to the number of smooth-bore guns and 8-inch converted rifles in readiness for service when the war broke out I have no precise knowledge. We are all aware, in a general way, that

such guns, although mounted in the past, are not infrequently retained in position, pending the completion of the modern batteries which are eventually to replace them. As a rule, they are not removed unless, or until, their sites are required for the new works.

The frankness with which we publish to the world at large information that other nations are most careful to conceal, has often been commented upon at home and abroad. In this instance, it would appear that the practice was beneficial in its results rather than detrimental, so far as the non-combatant public was concerned. To prove a negative is proverbially difficult, and the argument *post hoc ergo propter hoc* is never regarded as conclusive. What the Spaniards *might* have done, had not the Chief of Engineers published his report for the fiscal year ending June 30, 1897, is as promising a theme for speculation as the color of Venus' hair or the number of angels that can stand upon the point of a needle. Let us leave it to the casuists. This, at least, we *do* know, that the report was made, was freely accessible to the Spaniards, and that, in fact, they did not operate upon our coast. We surely cannot deny to our gallant foe of the late war the wisdom that counselled the acquiring of all possible information on the subject of our fortifications, especially when that information was exact, official and public. Nor can any one be blamed who believes that the report itself and the Spanish plan of campaign stood somewhat in the relation of cause to effect, however unable he may be to demonstrate beyond peradventure the existence of such a relation.

There is, of course, one point wherein our ignorance was marked. We credited Spain with a close approximation to the full paper value of her fleet. We did not know how lamentably deficient in readiness were the units of that fleet, nor how destitute she was of the material resources required to make the fleet a satisfactory weapon. We erred on the right side, however, for it is never well to underestimate one's adversary. But, granting that the Spaniards were as formidable in reality as the information at our command represented them to be, I am still of opinion that our fears that they might work damage on our coast were groundless. Also, I am quite ready to admit that, to a certain extent, the unsatisfactory condition of the Spanish navy entered as an actual factor in keeping Cervera away from our shores,

while yet holding the view that, had it been what we thought it to be, he would none the less have failed to visit us.

Looking back upon the events of the spring of 1898, even without that full knowledge which we now possess of what did happen, I think we should have been entirely justified in trusting the protection of our seaports to our harbor-defences and in employing the fleet in strict accordance with the strategic demands of the situation.

The engagement at San Juan, Porto Rico, and the frequent shellings of the batteries at Santiago have not taught us sailors to despise the value of guns on shore, even if they be of small calibre, like the Spanish 15-cm. B. L. R's and 24-cm. howitzers. Bear this in mind when you ask, "But were our fortifications formidable enough to give pause to the Spaniard?" and bear in mind that the 8-inch converted rifle (a very efficient weapon it is, too) was commonly found in our older works associated with smoothbores, some of which are of 15 inches in calibre.

From the condition of the problem it was not expected that our own fleet should take the rôle of the defence. We were too strong and were practically in home waters. The stationing of monitors here and there, of the Katahdin at Provincetown, and the formation of the patrol squadron, were concessions to popular clamor. They were not operations in coast-defence and should not be dignified with such an appellation.

The relief experienced by the public at home when news came of Dewey's action at Manila should suffice to prove the soundness of the view generally taken by naval authorities on the subject of war, especially by those of the English-speaking races—that in the navy lies our true coast-defence.

Says Sir George Clarke in Brassey (1899, p. 141): "Now, as always, ports containing essential naval resources or required for the protection of a commercial marine, require defence against naval raids, but the real protection of a coast-line must continue to depend on the mobile navy. The sum which a nation can spare for naval and military purposes is practically limited, and all superfluous expenditures upon coast-defence entails loss upon the sea-going fleet and the field army which are the real arbiters of war. . . . Americans who have marked the vigor and the initiation, the skill and the daring displayed by their navy in the recent war, cannot fail to understand where lies the true defence of their coast-line."

This view was practically expounded by Howard in 1588, by Torrington in 1690, by De Ruyter in 1672 and 1673, by Howe on our own coast in 1779, by Nelson in the early years of the nineteenth century, by Gideon Welles in 1861 and 1863, by Dewey and Sampson in 1898. Shall we not preach it and enforce it until the truth be recognized far and near?

To prove that we were by no means badly off in our harbor-defences, I give a brief summary of their condition drawn from official sources. The detailed exhibit may be consulted in the appendix to this article. Here, then, is a list of what we really had.

The *Penobscot and Kennebec* rivers were mined and defended by old works and old guns, some of 15-inch calibre.

Portland, Me., had old works, mines and the following new guns: in June, 1897, three 10-in. emplacements ready, two carriages and four guns delivered; June, 1898, five 10-in. guns mounted.

Portsmouth, N. H., had, in June, 1898, old works, mines, and two 8-in. guns mounted.

Boston had old works and mines. In June, 1897, there were sixteen 12-in. mortars, three 10-in. emplacements, essentially completed, and the armament delivered and being mounted; in June, 1898, of modern guns, eight 10-in. rifled guns and two R. F. guns were ready for service, in addition to the mortars.

Narragansett Bay had three works of older type and was closed by mines. In June, 1898, sixteen 12-in. mortars and two 10-in. guns.

New York, Eastern Entrance, had a number of masonry works of old types. In June, 1897, there were sixteen 12-in. rifled mortars, two 10-in. guns. By June, 1898, an 8-in. gun was also mounted and mines planted.

Staten Island had old works. In June, 1897, five 8-in. rifles ready. By June, 1898, in addition, four 10-in. guns, two 4.7 R. F. guns were ready and the Narrows mined.

Long Island had, apparently, on January 1, 1898, three 10-in. rifles and six rapid-firers. By June 1, 1898, a fourth 10-in. rifle would appear to have been in readiness.

Sandy Hook, by January 1, 1898, had old works, sixteen 12-in. mortars, two 12-in. rifles, two 10-in. rifles. By June, 1898, two more 10-in. rifles, two 4.7 R. F., three dynamite guns and lots of submarine mines.

Delaware River, masonry work of old style, June, 1897, and three 10-in. guns ready. June, 1898, three 10-in., three 12-in., two 4.7 R. F. and submarine mines were ready.

Baltimore, June, 1897, two old works. June, 1898, eight 12-in. mortars, one 12-in. and three 8-in. guns; the channel mined.

Washington, June, 1897, two works of old type, three 10-in. guns. June, 1898, five 10-in., one 8-in. guns and submarine mines.

Hampton Roads, June, 1897, two old works, one partially completed; three 10-in. guns and sixteen 12-in. mortars practically ready. June, 1898, in addition, a 10-in. gun, four 8-in. guns and three rapid-fire guns, 108 submarine mines.

Wilmington, N. C., June, 1897, one old work. June, 1898, four 8-in. guns and submarine mines.

Port Royal, S. C., June, 1898, two 4.7 R. F. This is the only place containing a naval station where the shore works were insufficient to repel a serious attack. On the other hand, what possible end could have been gained by the Spaniards had they ventured over the bar and reached a safe anchorage within? The safety of Port Royal was completely assured by its lack of strategical value. As against a mere raid the two quick-firing guns were entirely adequate.

Savannah, June, 1897, three old works. June, 1898, four 8-in. guns, two 4.7 guns, one 8-in. temporarily mounted. Forts Pulaski and Clinch in condition for service. Submarine mines.

Key West, a masonry fort with two 15-in. S. B., and ten 8-in. converted rifles. Mines. As the modern guns contemplated were not mounted, it may be inferred that they were not regarded as necessary.

Pensacola, two masonry works of old type, three 8-in. converted rifles. June, 1897, two emplacements for 10-in. guns ready. June, 1898, four 10-in., two 4.7 guns and submarine mines.

Mobile, June, 1897, two emplacements for 8-in. rifles ready, two almost ready. June, 1898, eight converted 8-in. rifles and four modern 8-in. guns, and two 4.7 guns, mounted. Submarine mines.

New Orleans, two masonry works of old type. June, 1897, nothing modern completed. June, 1898, one 8-in. converted rifle and seven 15-in. S. B., two 10-in. and two 8-in. modern guns and submarine mines.

Galveston, June, 1897, nothing modern. June, 1898, one 10-in. gun, eight 12-in. mortars and submarine mines.

Parenthetically, I submit, with all due respect, that Galveston would be safer without any defences at all. It is now a fortified place and can no longer claim exemption from bombardment.

As I run over this really formidable array of submarine mines and guns, ancient and modern, which were in readiness to welcome Cervera (I can find no better term), I confess to being unable to comprehend our own lack of confidence in our harbor defences.

As the Chief of Engineers was well along in his preparations, so was the Chief of Ordnance in the equally important matter of guns and ammunition. As to the guns, it is not to be imagined for a moment that his estimate for a date so important as June 30, 1898, can be very far wrong. This estimate gives 384 modern guns, of which 235 guns and mortars were of 12-in. calibre, as mounted along our shores. From this number should be subtracted those mounted on or allotted to the Pacific coast, 43 in all, and we see that 341 modern guns of large calibre were practically in readiness to meet any demonstration which the Spanish fleet cared to make on the Atlantic seaboard. Add to this showing the dynamite guns at New York, and the unstated but very large number of old-fashioned weapons, in which an excellent weapon, the 8-inch converted rifle, figures prominently, and we have a really formidable array of artillery, entirely effective against Cervera's squadron. All this, too, without taking account of the shoals of submarine mines.

Again, making due allowance for the guns of this category which were mounted during June, 1898, we still see that our coast was not only far from unprotected when Cervera sailed from St. Vincent, but was indeed so strongly armed, if we may judge from published correspondence, that, as has been said, it never entered into his head to suggest operation against our ports.

That there was panic among the denizens of our Atlantic States is a fact, but this panic was not justified by the paucity of our coast-defences, as has just been shown. Our brethren of the army had done their work too well and no such paucity existed.

Nor can it be urged that there was any lack of ammunition.

The Chief of Ordnance, U. S. Navy, says (report 1898, p. 53): "There was procured by the beginning of the war, a considerable

quantity of charcoal and smokeless powder which, with the powder on hand, brought the supply up to a reasonably safe point." As to projectiles, the same officer stated that "the Department had provided the following projectiles, which were mainly on hand, though a few were still under manufacture for the 67 8-inch, 82 10-inch, 18 12-inch guns, and 217 12-inch mortars (384 in all) that would be mounted in the fortifications by June 30, 1898, viz.:

"For 8-inch guns, 9 rounds of steel and 9 of cast-iron projectiles per gun.

"For 10-inch guns, 19 rounds of steel and 4 of cast-iron projectiles per gun.

"For 12-inch guns, 43 rounds of steel and 41 of cast-iron projectiles per gun.

"For 12-inch mortars, about 10 rounds of steel and 3 of cast-iron projectiles per gun."

"By June 30, 1898, the following quantity of projectiles was on hand or under manufacture for the number of cannon of different calibres above stated, viz.:

" 8-inch guns, 61 steel and 19 cast-iron projectiles per gun,
" 10 " " 65 " 21 " " "
" 12 " " 150 " 47 " " "

" 12-inch mortars, 32 steel and 9 cast-iron projectiles per gun.

"A total of 80 projectiles per gun for 8-inch guns, 85 for 10-inch guns, 197 for 12-inch guns, and 41 for 12-inch mortars." (C. O., 1898, p. 54.)

The amount of projectile per gun at the outbreak of the war was undoubtedly too small, but the energetic measures taken by the Ordnance Office made prompt remedy. If, on the first of June, the guns had only one-half the quota stated to have been available or nearly so on the 30th, and this is a reasonable assumption surely, it gives as a result:

40 rounds for 8-inch guns,
42 " " 10- " "
98 " " 12- " "
20 " " 12- " mortars.

The danger point would have been left far behind.

As in the case of the fortifications and gun emplacements, the details as to guns and ammunition are given in an appendix.

The fact that our harbor-defences were and are so extensive,

so powerful and so liberally supplied, being opposed to the notion generally held on the subject, I have not ventured beyond the limits of official statements.* The fact will probably come in the first nature of a surprise to others as it did to me, for I had supposed, from utterance by the exponents of what the English followers of Captain Mahan call the "bricks-and-mortar school," as well as from Captain Mahan's own recent contribution to military literature, that our harbor-defences were in a bad way. I am glad to receive and to proclaim the official assurances that such was not at all the case. And I am also glad to be able to show that the things done, which Captain Mahan could not, as a strategist approve, were caused first, last and always by popular and unreasoning alarm.

Passing from the specific to the general, and omitting the Penobscot and Kennebec rivers, and Port Royal, where nothing existed to attract the attention of the Spanish and where the works, such as they were, were entirely adequate to the repelling of a naval raid or dash, it is, I think, quite within the limits of accuracy to assert that at every important point our fixed defences were more than strong enough to drive off the Spanish fleet, even if the Pelayo and Carlos Quintos had been added to Cervera's command, and that a serious attempt to reduce them would have subsequently entailed great labor and expense on the part of the Light House Establishment in marking, with buoys and light-vessels, the sites of Spanish wrecks off our coast.

It is to panic, pure and simple, that we must attribute the splitting up of the North Atlantic fleet and the formation of the Flying Squadron, panic on the part of the people, so extended and so acute that it was able to force the hands of the administration. What it did for the navy we all know. Fortunately the arrival of the Spanish squadron in the West Indies soon relieved the strain and no great harm was done.

But I think on shore great harm *was* done. The mounting of guns at Bar Harbor, Me., Bridgeport, Stonington, New Haven, etc., for example, is distinctly unfortunate. It teaches the people to trust to weapons that are out of place, that are of no use, and that may only serve to warrant a bombardment. Once admit

* As to the need of so elaborate a scheme of shore works, now that the country possesses a strong and most efficient fleet of battleships, I express no opinion.

that an enemy might by any possibility pay towns and cities of that size the flattery of a hostile visit, and you have started on the road which will bring you out at a continuous battery from Maine to Texas. At the same time you will have weakened the public confidence in our true coast-defence—the sea-going fleet. In his report for 1898, the Chief Engineer, page 29, says: "At the outbreak of the war, Sabine Pass was entirely undefended and became an object of solicitude lest its recently improved harbor be made the subject of a Spanish attack . . . temporary batteries for four siege guns were quickly constructed and the guns placed in position. . . . Provision was also made for mounting an 8-inch B. L. rifle. . . . Material for an improvised mine defence was accumulated, but the progress of events rendered planting mines unnecessary."

This case is typical. How could Cervera have possibly justified to his government a descent on Sabine Pass or have answered the question: "Que diable allait-il faire dans cette galère?"

Panic is unreasoning or it would not be panic. Upon us devolves the necessity of preaching, in season and out of season, the true doctrine that the wisdom and efforts of the two services may be trusted to do the best that can be done. To-day we may smile at our fears and laugh as we read that at San Diego, California, five triple groups of mines were planted, three 10-inch rifles mounted and that the battery commander kept two Napoleon guns trained on the mine field, "while," at San Francisco, "a number of mines were successfully planted before the end of the (fiscal) year."

A fairy tale of my own invention? Not at all; it is an extract from the report of the Chief of Engineers of the Army for 1898. Of what use in allaying general dread was Dewey's wiping the Spanish flag off the Pacific Ocean if the populace a month later could make capable and responsible army officers do such foolish things against their wills?

Said Sir George Clarke: "The Genesis of the Flying Squadron may in fact be traced to an uninstructed outcry;" also "By far the most important lesson of the war—to the United States and to Great Britain—is the danger that uninstructed public opinion may usurp the direction of naval policy."

So unreasoning is panic that it may be confidently asserted that

no sum of money, however vast, expended in military defences will in future relieve the Navy Department of the pressure of the demands for local floating defence or measurably decrease the apprehension in the public mind. If the experts in this branch are satisfied (as they should be) with the preparedness of our defensive works, it is time to announce the fact to our non-combatant countrymen and bid them quiet their fears. Those whose duty it is to protect them have not been negligent. Our forts are sufficiently advanced and our navy is equal, or will be so equal very shortly, to the rôle it should play in coast-defence. If this statement is incorrect, then official reports are of no value and we have read naval history in vain.

So convinced am I of the efficacy of our present fortifications that I am ready to go on record at this moment as believing that if not another gun were mounted than now are actually mounted no power in existence or that may arise in the next twenty years, would venture on a naval demonstration against any one of our principal sea ports. Herein lies the encouragement of which I spoke at the beginning of this lecture.

The lessons of history have to be repeated over and over again for they seem to fall on deaf or reluctant ears. Nor do the professors always agree.

Sir George Clarke says:* "Apropos of coast-defence, Captain Mahan has laid great stress on the paralyzing effect of inadequate coast-defence, but the lesson of the war is of an opposite character. Judged by any modern standard, the coast-defences of Cuba were miserable; but a moderately effective fleet based upon Cuban ports would have found them ample, and they may be actually said to have served their purpose. The term "coast-defence" in relation to a naval power is commonly abused and misunderstood. Ports containing essential naval resources, or serving as the basis of a commercial marine require small permanent defences sufficient to prevent a naval raid. How small these defences may be, Santiago shows. Half a dozen 6-inch Q. F. guns well mounted and well handled would have fulfilled every requirement. Towns situated on a long seaboard must take this chance. History shows that the defence of positions of this nature depends wholly upon sea power. If the naval conditions are such as to permit an enemy to attack them, it is the

* Brassy, 1899, page 172.

back door, the land front, which is invariably selected. The operations against Santiago supply only a fresh illustration of an ancient law."

That is to say, Clarke holds that ships would not attack strong places, but will cover the landing of an army to attempt the reduction of the works from the rear.

These are the lessons that I wished to force home, that fleets can not engage modern batteries except on fearfully unequal terms; that our worst foe is "uninstructed public opinion." The latter may be expected to again frustrate the intelligent efforts of our brethren of the army and to force upon us a faulty strategy unless we both manage, through a propaganda of enlightenment, to make it clear to all that the Army and Navy know their own business thoroughly and may be trusted to do for the people, when war comes, far better than the people can do for themselves. The two services have not, as yet, failed the country in its times of need. Until they do, they have a right not only to demand its confidence, but to enjoy that confidence to the fullest extent.

Appendix I.*

Penobscot River.—"The principal work done has been a partial cleaning of the old armament during the latter part of the fiscal year 1898. The fort was occupied by troops during a portion of the fiscal year." (C. E., 1898, p. 583.)

Kennebec River.—"During the fiscal year just ended, temporary wooden platforms for 15-inch guns have been constructed, and the carriages and guns mounted." (C. E., 1898, p. 584.)

". . . Mines were placed early in May in Kennebec and Penobscot rivers." (C. E., 1898, p. 15.)

Portland, Maine.—"The older type fortifications in the district have been kept in repair as far as the limited funds would permit." (C. E., 1897, p. 11.)

"Three of these emplacements (for 10-inch B. L. R's at Portland) were ready for their armaments at the close of the (fiscal) year, and all five will be completed during the present working season. Two carriages and four guns for these emplacements have been delivered.

* Extracts from Reports of Chief of Engineers (C. E.) for fiscal years noted. Bear in mind that the fiscal year ends on June 30.

"A mortar battery for sixteen 12-inch mortars (was commenced). . . . At the close of the (fiscal year) the excavation for this battery, which is all in ledge, was well advanced." (C. E., 1897, p. 12.)

Also, contracts had been made for the construction of two 12-inch emplacements here, to be finished December 1, 1897.

"Work was continued on emplacements for five 10-inch guns for the defence of Portland harbor, Maine. At the close of the year all of these were completed except a portion of the iron work, and all the guns were mounted." Page 15: "During April, 1898, mines were placed in three channels leading into Portland harbor." (C. E., 1898, p. 14.)

Portsmouth, N. H.—Two emplacements for 8-inch guns were contracted for, to be completed October 15, 1897. "The contract for Portsmouth harbor also includes the construction of a mining casemate." (C. E., 1897, p. 12.)

"The work is now nearly completed, and guns are mounted." (C. E., 1898, p. 15.)

". . . Mines were placed . . . early in May in Portsmouth harbor."

Boston.—"The mortar battery (sixteen 12-inch mortars) was completed in all its details, and has been transferred to the care of an artillery garrison. Three 10-inch emplacements are essentially completed and their armament delivered. This armament is being mounted by artillery troops, two carriages being in place at the close of the year. Four additional 10-inch emplacements are ready for their armament, although considerable work still remains to be done."

There are three works of older type, one used as a torpedo store house (p. 602). "One casemate for a rapid-fire gun (one of two 5-inch guns authorized) is completed with the exception of opening the port." (C. E., 1897, p. 12.)

"At the close of the previous fiscal year there had been provided . . . emplacements for eight 10-inch guns on disappearing carriages, a mortar battery for sixteen 12-inch mortars. . . . All the 10-inch emplacements were essentially completed at the close of the fiscal year, and all the guns mounted ready for service. The sixteen mortar battery has been in charge of the troops since July 25, 1896."

"At the close of the fiscal year two rapid-fire guns were mounted."

"In anticipation of the war with Spain, preparations were commenced early in April, 1898, for planting mines for the defence of Boston harbor. . . . A total of ten grand groups of service pattern mines were planted and maintained in effective condition to the close of the fiscal year." (C. E., 1898, p. 16.)

Narragansett Bay.—"The defences comprise three works of the older type."

"At the close of the (fiscal) year this battery (sixteen 12-inch mortars) was well under way, and platforms for twelve mortars completed and the base rings set."

"It is expected that the emplacements (for three 10-inch rifles) will be essentially completed at the close of the present working season." (C. E., 1897, p. 12.)

Both batteries were completed during the fiscal year, the armament placed in position for service, and the batteries formally transferred to the troops for use and care in June, 1898.

"The defences include two permanent masonry works of old type."

"During the months of April and May the entrance to Narragansett Bay were closed by mines and special rules for navigation put in operation." (C. E., 1898, p. 17.)

Eastern Entrance, Long Island Sound.—For two emplacements for 12-inch rifles, disappearing carriages, contract was made, "work to be completed November 1, 1897." "There is every reason to believe that the work will be completed on time." (C. E., 1897, pp. 13, 608.)

"The battery (12-inch) awaits its armament; a 4.7-inch gun (is) mounted ready for service." (C. E., 1898, p. 18.)

"For the defence of New Haven, temporary batteries for six 10-inch smooth-bore guns were constructed. . . . Similar temporary batteries were planted for four and one gun, respectively, were constructed at Bridgeport and Stonington. Submarine mines were planted for the defence of New Haven harbor." (C. E., 1898, p. 18.)

Eastern Entrance to New York Harbor.—"In addition to the new work begun during the year, the modern defences include a mortar battery for sixteen 12-inch mortars and emplacements for two 10-inch and one 8-inch guns, on disappearing carriages, which are essentially completed and armed, except the 8-inch emplacement, for which no guns or carriages have been received." (C. E., 1897, p. 13.)

The defences include a number of masonry works of old type.

"The armament of the two 10-inch emplacements and of the one 8-inch emplacement is in position for service."

"The channel was defended by 59 submarine mines planted in April and May." (C. E., 1898, p. 12.)

Staten Island.—Battery of five 8-inch rifles on disappearing carriages "is now complete." (C. E., 1897, p. 613.)

Four emplacements for 10-inch guns "were essentially complete and awaiting their armament." (C. E., 1897, p. 14.)

"On Staten Island four emplacements for 10-inch guns on disappearing carriages, nearly completed at the date of the last Annual Report, have been completed and armed."

"At the close of the fiscal year the rapid-fire emplacements (for two 4.7-inch R. F. guns) were completed and armed." (C. E., 1898, p. 19.)

Long Island.—It is difficult to determine from the Report of the Chief of Engineers the exact condition of these defences, but it seems probable, from the statement on page 615, that "emplacements Nos. 6 and 7 are ready for service in every respect," and that "emplacement No. 5 is completed ready for service, excepting the ammunition lift;" that at the close of the fiscal year 1897 there were mounted, and practically ready for use, on Long or Coney Island, three 10-inch rifles and six rapid-firers, probably 6-pdrs. (C. E., 1897, pp. 14, 614.)

Sandy Hook.—Prior to the fiscal year 1897 there were at this point a battery of sixteen 12-inch rifled mortars, also two 12-inch rifles. During that fiscal year there were completed five emplacements for 10-inch guns and four casemates for rapid-fire 6-pdrs., "except mounting a portion of the armament." (C. E., 1897, p. 14.)

At the close of the fiscal year 10-inch battery No. 1 of two guns "was complete in all details except the ammunition hoists." (C. E., 1897, p. 621.)

"During the year the four 10-inch emplacements were completed and armed." (C. E., 1898, p. 19.)

"At the close of the fiscal year, two rapid-fire emplacements were completed and armed with 4.7-inch guns." (Page 20.)

"Submarine mines were planted at the Narrows and at Sandy Hook entrance, about 250 mines having been placed in position." (C. E., 1898, p. 20.)

Apparently by the first day of January, 1898, there were at the southern entrance to New York at least the following modern guns, mounted and ready:

On Staten Island.....	Five 8-inch rifles,
On Long Island.....	Three 10-inch rifles,
	Six 6-pdrs.,
At Sandy Hook.....	Sixteen 12-inch mortars,
	Two 12-inch rifles,
	Two 10-inch rifles.

"On the outbreak of hostilities between this country and Spain, the Department at once placed in serviceable condition the pneumatic dynamite gun batteries located at the ports of New York and San Francisco. A supply of explosive gelatine was procured for filling the shell and arrangements made with the company for filling the shell and doing any needful work on the fuses which were in store." (Report of Chief of Ordnance, U. S. A., 1898.)

Delaware River.—"The main battery is practically completed. The three 10-inch guns are mounted in position and the three 12-inch guns can be mounted as soon as the guns and carriages are received." (C. E., 1897, p. 14.)

"It is estimated that two emplacements for 5-inch rapid-fire guns can be ready to have the guns mounted in them by August 15, 1897." (C. E., 1897, p. 635.)

"The defences include one masonry work of old type which was garrisoned for a portion of the year as a result of the war."

"The battery of six 10-inch and 12-inch disappearing guns is completed, the guns and carriages are mounted and the ammunition hoists, electric lighting system, cranes, etc., are in full working order."

"Two 4.7-inch rapid-fire guns, purchased in England, were received on April 23, 1898. Twelve days later they were mounted on temporary platform ready for service."

"Submarine mines for the defence of the Delaware were planted in April and May, 1898." (C. E., 1898, p. 21.)

Baltimore.—"Nothing modern completed but two old works still existing." (C. E., 1897, p. 15.)

". . . Emplacements have been provided for a battery of eight 12-inch mortars, a battery of one 12-inch and three 8-inch guns on disappearing carriages. . . ."

"These works were all completed and armed during the year. . . ."

"The channel leading to Baltimore was obstructed by submarine mines." (C. E., 1898, p. 22.)

Washington.—Three 10-inch guns on disappearing carriages were in place.

Emplacement for a fourth 10-inch gun and three emplacements for 8-inch guns were to be completed on September 1, 1897. (C. E., 1897, p. 15.)

"The defences include two works of old type."

"At the close of the fiscal year all the foregoing emplacements were completed and the guns mounted ready for service."

"The 10-inch gun on non-disappearing carriage, intended for testing the experimental parapet was mounted upon a temporary platform, so as to be available for service in case of an emergency."

"Submarine mines were planted in the channel." (C. E., 1898, pp. 22 and 23.)

Hampton Roads.—Three 10-inch guns and a battery of sixteen 12-inch mortars complete or practically so. (C. E., 1897, p. 16.)

Besides the foregoing, "operations were in progress upon an additional emplacement for a 10-inch gun on disappearing carriage, and for three emplacements for 8-inch guns on disappearing carriages. . . ."

"The defences include two inclosed masonry works of old type, one of which is only partially complete."

"During the year the mortar battery was finished and armed." "An 8-inch rifle . . . was mounted under cover of one of the mining casemates . . . making it part of the permanent project of defence." "Three (additional) 8-inch guns and three rapid-fire guns were mounted ready for service."

"The channel was obstructed by 108 submarine mines." (C. E., 1898, p. 23.)

North Carolina.—"The defences include three works of old type, two of which are in ruins."

". . . Emplacements for three 8-inch guns on disappearing carriages were . . . completed and armed during the year."

An additional 8-inch gun was also mounted.

"Submarine mines were placed in the Cape Fear River, at the outbreak of the war." (C. E., 1898, p. 24.)

Charleston.—"The modern defences consist of a mortar battery for sixteen 12-inch mortars and a gun battery for three 10-inch guns on disappearing carriages. . . . At the close of the fiscal year, the mortar battery was completed except the floors and drainage system, and sixteen carriages and eight mortars were mounted. Excellent progress has been made by the contractors for the gun battery, and at the close of the fiscal year the work was about six-tenths completed, with every prospect of its being finished before the close of the present working season. (C. E., 1897, pp. 17, 675, 693.)

"The defences include four old type works."

"During the year . . . the (mortar) battery (was) completed and all the armament placed in position."

"Four 10-inch guns on disappearing carriages were mounted by the artillery." (C. E., 1898, p. 24.)

"The entrance to Charleston harbor was defended by submarine mines." (Page 25.)

Port Royal.—"Two 4.7 rapid-fire guns were mounted here." (C. E., 1898, p. 25.)

Savannah and the Coast of Georgia, etc.—"The defences include three masonry works of old type."

At Savannah, presumably, "the battery of four 8-inch guns on disappearing carriages . . . was substantially completed and the guns mounted before the end of the year."

"Two 4.7-inch guns were mounted." (C. E., 1898, p. 25.)

"An 8-inch B. L. rifle on non-disappearing carriage was temporarily mounted . . . for the defence of Savannah. The existing old armament at Forts Pulaski and Clinch was overhauled, repaired, and put in condition for service."

"Submarine mines were planted for the defence of Savannah." (C. E., 1898, p. 26.)

"For the defence of Brunswick and Darien, Ga., and Fernandina, Florida, temporary batteries, mounting three 10-inch smooth-bore, six 100-pdr. Parrott, and four siege guns, were constructed at a number of entrances to the inside water route." (C. E., 1898, p. 26.)

East and West Coasts of Florida.—"Temporary batteries for mounting field and siege guns were built at the mouth of the St. Johns River, at St. Augustine, at Miami and at Tampa Bay."

"An emergency system of mine defence was provided for at the

St. Johns River, and preparation for placing mines in Tampa Bay were under way." (C. E., 1898, p. 26.)

Key West.—Four 10-inch and two 8-inch guns on disappearing carriages and eight 12-inch mortars to be mounted. The emplacements were to be completed January 1, 1898.

Also a mining casemate and cable gallery commenced. (C. E., 1897, p. 17.)

"The defences include one masonry work of the old type, in which . . . two 15-inch smooth-bores and two 8-inch converted rifles were . . . mounted."

"Submarine mines were planted for the defence of the harbor." (C. E., 1898, p. 27.)

Note.—The modern guns were not mounted as expected.

Pensacola.—Four emplacements for 10-inch guns on disappearing carriages "are ready for their armament."

It appears that there were three 8-inch converted rifles mounted on concrete platforms. (C. E., 1897, p. 18.)

"The defences include two masonry works of old type."

"During the year a battery of four ten-inch guns on disappearing carriages was completed in all details, the guns mounted and the battery transferred to the artillery for use and care."

Two 4.7-inch rapid-fire guns were mounted.

"Submarine mines were planted and maintained in condition for service." (C. E., 1898, p. 27.)

Mobile.—Four 8-inch rifles proposed.

"The first two emplacements have been ready for their armament some time; the second two will be ready in a few weeks." (C. E., 1897, p. 18.)

"Eight 8-inch converted rifles were mounted."

"A battery of four 8-inch guns on disappearing carriages . . . was substantially completed, and the guns mounted."

Two 4.7-inch rapid-fire guns were mounted.

"The entrance to the harbor was obstructed with submarine mines." (C. E., 1898, p. 28.)

New Orleans.—Nothing modern completed.

"The defences of New Orleans include two masonry works of old type. . . . At the outbreak of the war, one 8-inch converted rifle and seven 15-inch smooth-bore were mounted. . . ."

"Two 10-inch guns, on disappearing carriages mounted, also two 8-inch guns."

"Submarine mines were planted in the Mississippi River." (C. E., 1898, p. 28.)

Sabine Pass.—"At the outbreak of the war, Sabine Pass was entirely undefended, and became an object of solicitude lest its recently improved harbor be made the subject of a Spanish attack. . . . Temporary batteries for four siege guns were quickly constructed and the guns placed in position. . . . Provision was also made for mounting an 8-inch B. L. rifle."

"Material for an improvised mine defence was accumulated, but the progress of events rendered planting mines unnecessary." (C. E., 1898, p. 29.)

Galveston.—Two 10-inch guns on disappearing carriages.

"It is expected that the battery will be finished by August 31, 1897. (C. E., 1897, p. 19.)

"One gun mounted." "The mortar battery (eight 12-inch mortars) was substantially completed and the armament mounted."

"The entrance to Galveston harbor was obstructed by submarine mines." (C. E., 1898, p. 29.)

San Diego.—"Five triple groups of mines were planted at San Diego. Three 10-inch B. L. R's mounted between April 19 and May 23."

"The battery commander has two Napoleon guns trained on the mine-fields." (C. E., 1898, p. 30.)

San Francisco.—"A number of mines were successfully planted before the end of the year." (C. E., 1898, p. 31.)

Appendix II.*

Guns and Ammunition.—"Thus far the Department has been able to complete and furnish carriages as fast as the fortifications were ready for them." (C. O., 1897, p. 36.)

"In the sea-coast gun department the number of guns finished during the year was as follows:

Thirteen 8-inch,
Twenty-two 10-inch,
Seventeen 12-inch (C. O., 1897, p. 173),
One 10-inch disappearing carriage."

Six 12-inch mortar carriages, begun before, were fully completed.

* Extracts from the Reports of the Army Chief of Ordnance (C. O.) for the fiscal years noted. Bear in mind that the fiscal year ends June 30.

In addition, the following were completed during the year:

One 12-inch disappearing carriage,
Four 12-inch barbette carriages,
Five 10-inch disappearing carriages,
Five 8-inch disappearing carriages.

Also, not completed now, but will be ready for issue in the early fall:

Four 12-inch disappearing carriages,
Three 8-inch disappearing carriages,
Three 12-inch barbette carriages (C. O., 1897, p. 178).

"The following guns, mortars and carriages, of new construction, have been issued from this post (Sandy Hook) during the year, for installation in sea-coast fortifications built especially for their reception:

2 8-inch B. L. R.,
22 10- " "
6 12- " "
6 12- " " mortars."

36

6 10-inch disappearing carriages,
1 12-inch barbette carriage,
1 12-inch lift carriage,
6 12-inch B. L. mortar carriages.

"Also 35 mortar carriages (out of 57 contracted for) from Robt. Pool & Son Co."

"A second contract for 35 more, making 92 in all, to begin delivery in October, 1897, and finish end of April, 1898." (C. O., 1897, p. 21.)

"During the past year the following guns and mortars, of modern construction, have been issued from this post (Sandy Hook Proving Grounds) for installation in sea-coast fortifications, viz.:

34 8-inch B. L. R.,
36 10- " "
6 12- " "
69 12- " "

145 (C. O., 1898, p. 40)."

number of sea-coast cannon and carriages mounted estimated to be mounted at the date given," June 30, 1898:

4-inch Driggs-Schroeder carriages, with pedestal mount,	4
5-inch barbette carriage or pillar mount	1
8-inch barbette carriage, model 1892	8
8-inch barbette carriage (altered)	21
8-inch disappearing carriages, L. F. model of 1894	25
[illegible]-inch disappearing carriages, L. F. model of 1896	13
[illegible]ch barbette carriages, model of 1893	5
[illegible] disappearing carriages, L. F. model of 1894	34
[illegible] disappearing carriages, L. F. model of 1896	43
[illegible]-inch barbette carriages, model of 1892	8
[illegible]-inch lift carriages, model of 1891	2
[illegible]ch altered lift carriages, model of 1894	3
[illegible]ch disappearing carriages, L. F. of 1896	5
12-inch mortar carriages, model of 1891	85
12-inch mortar carriages, model of 1896	132
Total	389

(C. O., 1898, p. 44.)

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

OUR NEED OF FIGHTING SHIPS.

By COMMANDER J. B. MURDOCK, U. S. N.

The first vital point affecting our policy of naval construction is that it should be adapted to the needs of the country. The time long since passed for us to buy plans abroad; we should now stop copying foreign designs. An exhaustive study of all European construction is of course a necessity and details may be copied with advantage, but the general plan of our ships should be not only distinctive, but designed for the accomplishment of whatever ends our navy may be called upon to perform.

While admitting the idea that our naval policy should dictate our construction, there may be much diversity of opinion as to what that policy should be. In the highest sense it depends on the foreign policy of the government, and is therefore beyond the sphere of our discussion as naval officers, but there is still much left to us, as our preparations should be such as to fit the navy in a general way for all eventualities, and we are neglectful of our duty if we fail to note and allow for every advance made by any naval power.

Let us examine the task which war with a first-class power would impose.

The theatre of future warfare between the great powers will be the world. Military campaigns will be carried on, but except on the continent of Europe, where large populations are associated in close contact, it will be impossible to assemble and operate the large armies characterizing the warfare of the last century. The military operations of the future are foreshadowed in the recent fighting in South Africa, China and the Philippines, and problems of transport and subsistence become vital. We should

drop forever the old hackneyed idea that the sea separates us from other powers. It does not; it brings us into contact with them. How could England have moved 300,000 men six thousand miles except on the sea? This great international highway, while nominally free to all, is in reality reserved to the strongest, and this question of strength is a purely naval one. A nation may have an invincible army and yet in war be restrained impotent in its own borders, if it has failed to provide in advance sufficient naval force to allow it to assert its claim to free transit at sea.

The events of the last decade have made the United States a world power in spite of itself. Our navy, which formerly had only to protect our coasts from naval attack, is now charged with the vastly more difficult task of keeping open the communications between isolated areas of American territory. As the battle of Manila decided the destiny of the Philippines, and that of Santiago made the loss of Cuba and Porto Rico a certainty to Spain, so a like reverse to our navy in a future war might cause a transfer of any of our outlying possessions to some other power. Military strength would be of no more avail than it was in Cuba in 1898, when, with their communications with Spain severed by the loss of Cervera's fleet, there was nothing in store for the 100,000 troops in Cuba but surrender or evacuation. In such cases military strength is but weakness, and the navy becomes the real support of national sovereignty.

We have seen in late years the transfer of large bodies of troops by sea, but this has taken place only when the transferring power has assured itself that there was no danger to fear in transit from an enemy's fleet. The Japanese landed troops in Korea before the battle of the Yalu, but not before they had satisfied themselves of their power to keep the Chinese fleet out of the way. The defence of a convoy is a matter of so much difficulty, and while inviting attack it is in itself so utterly defenceless, that a military expedition would hardly be sent to sea unless its security were guaranteed in advance by the seclusion or defeat of the enemy's naval force. Naval strength is thus a preliminary to military operations over sea, and must be maintained to insure transit of supplies. If lacking at any time, complete military failure may result.

The preceding arguments may not appeal to some of our citi-

zens, the anti-expansionists, who look upon our stepping outside our continental limits as an error and almost a crime, but even among the opponents of militarism there is a belief in the Monroe doctrine and many of them are earnest advocates of our control of the Isthmian Canal.

If there is any one feature of our foreign policy that has become ingrained in the thought of the nation, it is the Monroe doctrine. It apparently appeals to all shades of political opinion and to all classes of society. Any discussion of the principles of foreign policy involved is of course outside the sphere of this article. It is, however, a matter of common knowledge that the doctrine attracts considerable attention abroad and that frequent references are made to it in foreign publications. Without in any degree accepting or advocating these foreign views, they are necessarily interesting to all Americans, as showing how others see us and our affairs. As an example of foreign ideas on the subject, we find the following in the columns of the conservative London *Spectator*, of date of January 6, 1900:

> The German Emperor is no enemy of America, but he has steadily fixed his mind upon a policy which runs directly counter to one of the chief maxims of American statesmanship, and he is now using the usual German "foresight" in order to make that policy practical. His demand for a fleet, and his insistence upon obtaining it, just as his grandfather insisted upon obtaining an army, is not based upon any vague and shallow idea of having a splendid plaything. Again, he does not want a fleet in order to get anything out of England, for he knows that he has already got out of us most of what he wants, and also that the destruction of our fleet would be too hard a nut to crack. He wants a fleet in order that when he puts his South American policy into operation he will not be made ridiculous by an order from Washington. Mark, he does not want to attack America in the very least, but merely to have the proper physical backing when he asks the United States not to play dog-in-the-manger any longer in regard to Spanish and Portuguese America. He believes that when he occupies the Rio Grande do Sul the Americans will waive the Monroe doctrine if his fleet is equal to or stronger than theirs. Was it not with such an idea in his mind that in his New Year's speech on the need of a navy he declared: "If any thing has to be done in this world the pen will be powerless to carry it through unless backed by the force of the sword?" Germany and the German Emperor want a fleet, then, not for parade or to flaunt in other people's faces, but in order to do something definite with it, and that something is making America give up what the Germans regard as her dog-in-the-manger attitude.

* * * * * * * *

When we speak of the German Emperor's South American Policy it must not be considered that we mean to imply that this is to be begun this year, or next year, or even in five years' time. It may be a very long time before the foundations of the new Empire will be laid, but meantime "foresight" is at work, and the work of preparation will be pursued. They will not be provocative, or in any sense essentially unfriendly to America, but they will be absolutely thorough. Now, under these circumstances, we think that America should look ahead, and not copy the policy of drifting which has so often proved injurious to the Old Country. That is, America should make up her mind whether she means, when the time comes, to insist rigidly on the Monroe doctrine. If she does not, and there are many very good reasons why she should abandon it, she need not trouble herself at all about German aspirations, for they will not injure her. After all, as the Germans argue, America does not want Brazil for herself, and therefore she need not mind Germany having it. There is no other point on which the Germans will touch her. Indeed, on all other matters Germany will show the utmost friendliness, not so say compliance, in regard to America. If, however, America really means business about the Monroe doctrine, and really thinks it is of importance to her national welfare to enforce it, she must not go to sleep. She must see to it, that is, that she has naval and military resources equal to the strain of maintaining a policy so tremendous. If not, she is certain to suffer a great humiliation at the hands of patient, efficient, and persistent Germany. Germany, when the hour comes, will not be "bluffed" into respect for the Monroe doctrine. She will "call" America's fleet, and if that fleet is not higher than hers Germany will act. If, however, it is superior America will never even hear of the danger to which the Monroe doctrine is now exposed. Let us say once again, we do not believe for a moment that Germany has any designs against the United States herself or bears her any ill-will. She is merely working steadily for an aspiration which comes in violent conflict with a certain American aspiration—the Monroe doctrine. Hence any one who likes to use his eyes can see that either the Monroe doctrine will have to be given up or its defence properly prepared for. Any halting between these policies must prove either disastrous or at any rate humiliating for the United States.

The same journal in another article on May 5, 1900, again referred to the Monroe doctrine:

Americans must make up their minds, and without delay, whether they mean to keep up the Monroe doctrine or to abandon it. If they mean to maintain it they must supply themselves with the necessary force. And they must remember that the force required will not be of a passive kind. It is no good for the Americans to talk about eighty millions of people, brave and rich and patriotic beyond example, being able to defend themselves against all comers, even without preparation. No doubt they can for home defense rely quite safely upon improvising an army. But this

kind of passive power gives no support to the Monroe doctrine. Let America rest assured that no power which wishes to challenge the Monroe doctrine will dream for an instant of invading America. What will happen when the Monroe doctrine is challenged will be something of this kind. Germany, to take a concrete example by way of illustration, will get into a dispute, say, with Brazil, and will prepare to occupy the southern provinces in order to protect her subjects and restore order. America will thereupon quote the Monroe doctrine, and then the Monroe doctrine will be quietly but quite firmly ignored. The next move will be America's. If she is strong enough she must send her Fleet wherever the German fleet is to be found and destroy it. If and when that is done, nothing will be easier to enforce the Monroe doctrine, for nobody can reach, much less hold, a part of Brazil or Central America without having the command of the sea—or at any rate the relative command of the sea. It comes, then, to this, that the Monroe doctrine must be founded on sea-power, and if America means seriously to enforce it against all likely comers, she must have a naval force capable of doing the work. But, clearly, if while Germany is building ships America is doing little or nothing, America will not be in a position to fetter Germany's will, or to tell her she shall not make what terms she likes with the South and Central American powers. And remember that America must do more than merely build. She must engage and train in sufficient numbers the men without whom the best ships are useless. Her present officers and men are as good as possible. They have superiors nowhere, and only equals in the sister-navy of Great Britain. But there are far too few of them, and a naval officer cannot possibly be improvised.

Another point on which there is a strong feeling among our people is that of an inter-oceanic canal. While there is by no means the interest in this that there is in the Monroe doctrine, there is unquestionably a widespread conviction that the United State has a greater interest in the canal than any other nation and should therefore "control" it. Control of an international thoroughfare, such as the canal must be when finished, is a very delicate question. While it might appear perfectly reasonable to us to impose certain restrictions, these on the other hand might be obnoxious or even intolerable to other nations; and in that event they could be carried out only by force. As the canal will lie in foreign territory inaccessible to our army, its defence or control must fall on the navy. It thus becomes another dependency, communications with which must be kept open on two oceans. But these oceans afford ready access to the canal for any power having a naval force, and our control is possible, therefore, only by predominant naval strength, both in the Atlantic and Pacific. This is certainly a very large contract for

us to assume "in addition to our other duties," yet current discussion about our control of the canal runs on as flippantly as though it was to connect the Chesapeake with the Delaware.

We have not yet reached the point of making our foreign trade a national interest. We see other powers intriguing and striving to extend their commerce by all methods, and watch their jealousies and struggles comparatively unmoved. Our trade with North China was larger than that of any other nation, and is threatened with absolute extinction, but it arouses no popular feeling. There is no insistent demand on the part of the nation at large that the Government should take any decisive action in China in protection of our commerce. And yet with this comparative indifference to foreign trade is coupled the fact that in the last fiscal year our export trade was larger than that of any other nation. This commerce has not grown up, however, through any concerted effort either on the part of our Government or of our manufacturers. Like our national expansion, it has come in spite of ourselves. Our manufacturers still look mainly to the home market, and the popular idea of foreign trade is that of selling products for cash rather than of exchanging goods. Reciprocity treaties are at present having a hard time of it, and no legislation is ever obtained directly in favor of our foreign commerce. It is inconceivable, however, that this will continue. Our capacity for manufactures is so greatly in excess of any possible home consumption that we must look more and more to opening up markets abroad. The advances we have made in the last few years show what we may expect when our people really make a *business* of foreign trade. We shall then find that we are in the thick of the international complications resulting from the struggle for trade, and although we may never go so far as to seize territory in order to monopolize its trade, we are just as likely to get into trouble by advocating the "open door." With the exception of Great Britain, the efforts of European powers are now more generally in the line of obtaining special commercial concessions, and the open door policy is unpopular with all monopolists.

Copying again from the *Spectator*, we find an interesting review of the question of international trade complications, with their possible consequences in the issue of April 20, 1901. The following is an extract:

The annoyance of the Continent with America, which is very deep, is based upon three reasons. There is first of all, a dread, or rather a conviction, that competition in business with America is nearly impossible. Her wealth and energy are too great, and both are employed, as Continentals think, to monopolize trade, and so control in the end all the wealth of the world, an idea not without advocates even among ourselves. These giant trusts are regarded as enemies, inexpressibly formidable because they do not raise prices, which would to traders be some compensation, but look to monopoly of business as their reward, and because, if the governments fence them off with tariffs, the Americans, being Protectionists, do not scruple to commence quick and severe reprisals. As the governments are always trembling with nervousness lest their industrials, if driven out of work, should turn to Socialism as a refuge, this cause alone inspires them with a permanent suspicion and dislike of American action. Then they see, as yet dimly, but still without doubt, that America will interfere grievously with their plans for securing new and permanent markets. America does not interfere in Africa because Africa is negro; but the hopes of Continental Chancellors of the Exchequer turn to Asia, and in Asia it is clear that America will be sadly in their way. The whole action of Washington in this Chinese muddle points to a single conclusion, that although Americans took the Philippines, they are unwilling to see any but native powers in possession or control of the richer countries of Asia. They do not much mind England, because she admits all the world to share her commerce, or Russia, because they regard Manchuria as a mere railway route, but they are utterly opposed to a partition of China, or a subjugation of Japan, or any other great change which would place their manufactures at a disadvantage. That opposition is most irritating to men who sincerely believe that open trade is of no use to them because America and England are sure to get it, and who look therefore to conquest in one form or another as the only permanent protection for their industry. The bitterness is all the deeper because it is, in a sense, philanthropic, those who feel it honestly pitying their own people, because they cannot, in the fierce competition which prevails, get enough work to do. And lastly, every State on the Continent feels keenly the dog-in-the-manger attitude of America about the future of South America. She will neither take it nor let anybody else. There lies the vast continent with scarcely anybody in it, with climates, which, though varied, do not prohibit European labor, with sources of wealth in the soil that are practically limitless, and with vast rivers which render entrance into the far interior at once cheap and easy. There is no prize left in this rapidly dwindling little planet like South America. Germany would like the whole of Brazil, in which she is already strong; Italy even now sends her children by the hundred thousand to Argentina; France would feel richer if she could acquire the Hinterland of Guiana; and even Hungary would much rather that her Slav children, who in tens of thousands are doing the hard work of North America, should find acceptable homes under their own flag in Uruguay. All are warned off by the Union in a way which, as she will

not annex, or even allow herself to be responsible for these territories, seems to the statesmen of the Continent the very height of selfish impertinence. Why, they think, should their children be shut by a pure caprice from natural and profitable careers? The total result of these feelings, is a bitter dislike of America, mixed with a certain dread that produces the sense expressed alike by Count Goluchowski and Count Canevaro, and not obscurely hinted at by Count von Bülow, that a league of Europe against America will ultimately prove to be "a necessity of civilization."

Our friends in America, who are incurably optimist, believing that whatever happens all will go well with them, will not credit our description of the situation, or will even imagine that we are only pleading for the Anglo-Saxon alliance which we have so often predicted for the future. They are in error. We have not stated the case against the Continent—and especially in regard to Germany's aspirations and aims—half as strongly as we believe it ought to be stated, and we are entirely at ease about the Anglo-Saxon alliance. That is safe enough in the fulness of time without any help from publicists. Our object is only to waken Americans from an illusion, to induce them to increase their fleet steadily instead of by rushes, and to persuade them, if we can, to think out what they are doing, and not act, as we too often do, upon the spur of the moment. They may rely on it that the Continent will lose nothing for want of planning, and that when the alliance against America of which Count Canevaro talks is transmuted from a hope into a fact, the fact will be full-grown and armed.

These comments of the *Spectator* are certainly most interesting.

The trade of the future, or at least the trade that is to be developed, will be mainly on the Pacific. Its shores are bordered by nations containing half the population of the world. As yet, these masses are dealing with each other indirectly, China trading, for example, with New York and London rather than with San Francisco, but the next few years will see direct routes established that will make the Pacific the ocean of the world. We are involved in this future development from our position, whether we wish it or not. Back of San Francisco, Seattle and other cities of our Pacific coast, lie the industries, resources and commercial vigor of our nation, and all will come into play as soon as it is evident that there is a new field for them in Asia. We are not seeking this, but it will inevitably come. The future may thus see struggles for trade supremacy in the Pacific, which will be all the sharper and more bitter from the fact that there is so much to be obtained by the first comer or the most unscrupulous.

After this casual examination of the field it is needless for us to select any nation as our special antagonist. We are liable to

have trouble from one reason or another with almost any of the powers and must consider war as a possible result. Personally, I believe that we have fought our last war with Great Britain. The numerous questions arising in the future will be settled as their predecessors have been for the last eighty years, by diplomacy and not by arms. If this is admitted, it frees us from the necessity of considering the British Navy in our plans, and materially simplifies matters.

As we analyze the work thus outlined for our navy, we find it almost entirely of a military character. Even maintaining communications with outlying possessions is not a mere matter of policing the sea, but rather involves the destruction or capture of any force by which they are threatened, and this demands two essentials in our ships—speed and fighting strength. Neither can be sacrificed. Without speed and coal endurance we could never catch our enemy; without fighting strength we could do nothing with him when caught. If we had any commerce to protect; if our trade routes were covered with American ships that might provoke attack, we would need fast, light armored ships to overhaul and destroy possible assailants. As this commerce is, however, almost non-existent, it is unwise for us to design special ships for its protection. Even if we were at war with Great Britain it would be unwise to spend money for commerce-destroyers, as they would not earn their cost. Only one thing can break up commerce, which, like that of England, is vital to her very existence, and that is blockade. Privateering, raids, or operations or so-called commerce-destroyers are mere incidents of war, affecting, perhaps, freights and insurance, but not in any way crippling or causing serious distress. Any power or combination of powers that seeks to apply the sovereign remedy of blockade to the British Isles must reckon with the British Navy.

The measure of success we may attain in a foreign war depends, therefore, purely and simply on naval strength, and this means not numerical but fighting strength. Whatever enemies we may meet can be overcome by force alone, and this must be of a kind which will be effective in a modern naval battle. Strategy and tactics are sometimes supposed to atone for want of fighting strength, and so they do to the extent of utilizing to the utmost what strength exists. Napoleon and Nelson, the

personification of military and naval science respectively, unite in demanding strength. "Providence is on the side of the stronger battalions," is just as true that "only numbers annihilate." If, therefore, we are to build our navy on true principles, are not the fundamental ideas, first, to have plenty of units, as many as possible, and second, to have every unit endowed with fighting strength. We should allow nothing to lead us away from the cardinal idea that the navy is for battle, as in battle only can the issues of war be determined.

In battleship construction we are well to the fore. We have to a certain extent been trying to please every one, our seventeen battleships, built or under construction, representing six different types. These are supposed to show a gradual improvement in design, but this has been questioned. As was very aptly said in the discussion of Mr. Taylor's article printed in the last number of the PROCEEDINGS OF THE NAVAL INSTITUTE, we seem to have abandoned the plan of building *better* battleships than other nations do, and to have substituted therefor the policy of building *as good* as any. Our first four battleships carried eight 8-inch guns, and were most unfavorably criticised by foreign critics as being "over-gunned." An undue tenderness for the opinions of others must have been operative in the abolition of the eight-inch battery in the Alabama and Ohio classes, and the substitution therefor of fourteen and sixteen 6-inch guns respectively. We copied foreign construction, and as a result have ships *as good* as any of their type anywhere. In the latest ships we have once more adopted the favorite eight-inch gun, and if we can get rid of the six-inch, replacing them by an equivalent weight of extra eight-inch, would again be building *better* fighting ships than our rivals. To face the point squarely, what is the reason for installing a six-inch gun in new battleships? Such a ship is designed to give and take hard blows, but the six-inch is not an armor-piercer, and is useless against the Krupp armor of recent ships at ordinary battle ranges. It is not a sound argument to say that the new gun is capable of injuring existing foreign ships, although this fact may be enough to justify its retention in ships already finished. The Virginia finds her contemporaries, however, under construction, and they, with their Krupp armor, are practically invulnerable against the six-inch. Why then install it? An opinion seems to exist in some quarters that a dozen

small guns can get their projectiles through armor that no one can pierce singly, but this is pure hypothesis if not humbug. The common-sense solution is to install guns that can put every shot through their opponent's medium armor, and the new eight-inch gun fills the requirements.

The question of battleship speed is the most difficult one to settle in connection with the type. It is hardly right to decry speed as enabling a fleet to run away but not fight. It will enable it to overhaul a slower fleet and bring it to action, and it unquestionably has a distinct tactical value in a fleet action. The old manœuvres of concentration as practiced at the Nile and Trafalgar are now impossible, when every unit of a fleet is highly mobile, and any threatened point of the fleet formation may be quickly reinforced. The principle of concentration remains, however, as true as before, and any fleet that can maintain its force in concentration against an enemy's flank or rear in action for five minutes will gain an advantage that may ensure final victory. This advantageous position may be gained by the bad manœuvring of the enemy, but if he is alert, can be ensured only by superior mobility. Speed is, however, only one factor of mobility, the other, frequently overlooked, but equally important, being handiness. A fleet of fast battleships, the speed being gained by increased length, cannot out-manœuvre slower ships with smaller turning circles. If this is true, we certainly want no 21-knot battleships, and may well ponder whether the gain of speed in the Virginia by the increase of under-water length is an advantage. An eighteen- or even a seventeen-knot "turn-about" is unquestionably a better tactical unit than a clumsy nineteen-knot ship. It must never be forgotten that the normal sphere of the battleship is in fleet formation and not on detached service, and that a fleet's manœuvring ability is measured by that of the slowest or clumsiest ship.

One of the most original of recent battleship designs is found in the Vittorio Emanuele III," of 12,625 tons, of the Italian Navy. This is on the principle of high speed at expense of fighting efficiency, but once more illustrates the ability of the Italian constructors in designing efficient compromises, the speed having been gained on moderate displacement without undue sacrifice of fighting power. The battery is to consist of two 12-inch and twelve 8-inch. These ships certainly have good fighting ability,

and by abandoning the 6-inch gun for the 8-inch, provide for effective fire against the most recent ships.

The most interesting feature of the Italian design is found in the fact that this fighting battleship has a cruiser's speed, 22 knots, and can apparently overhaul almost anything afloat, while at the same time capable of defeating almost everything, battleships excepted, that it can bring beneath its guns. No protected cruiser or gunboat, and but few armored cruisers, would have much chance of escape if once sighted by a ship of this class. If this type is successfully developed its influence on naval construction will be very marked. All large ships must be given guns, speed and armor to ensure their having a chance of life against it.

The new ships, by means of a most remarkable under-water body, aim to attain high speed while retaining excellent turning power. They are certainly a most fascinating combination and afford plenty of thought to students of battleship construction. A squadron of this type could choose its own time for battle, and if well directed would derive great advantage in action from its speed. Neither speed nor tactical ability could, however, when battle was once joined, overcome heavier guns or better armor, if equally well handled, and in battle only is the real test of battleship construction.

The armored cruiser has always furnished a fine theme for argument. If, however, the idea already presented—that the prime necessity of our navy is for fighting ships—is acknowledged as correct, it limits the field within which our designers must work. No armored cruiser can, of course, have the high speed necessary for cruising purposes, and also sufficient fighting strength to successfully engage a contemporary battleship, single-handed. It should, however, be strong enough to face any vessel of her class in a duel, or to mix in a general action, with and against battleships, under which circumstances individual contests between ships are extremely improbable. The requirements for a ship fit for the above purposes, *i. e.*, general cruising and also fighting in line-of-battle, may be summarized as follows: Speed, 22 knots; length about 400 feet with under-water body cut away so as to promote handiness and turning power; battery to contain at least eight or ten 8-inch guns of latest type, with a large number of 14-pdrs. for use against small vessels; armor, a complete belt of not less than four-inch Krupp armor to keep

out high explosives and protect the cellulose against small R. F. projectiles, and not less than six inches of armor over every gun of main battery. This combination is by no means impossible, and can probably be realized on a ship of about 10,000 tons without sacrificing the coal endurance necessary for efficiency.

The latest type of eight-inch gun may be classed as a rapid-fire armor-piercer, and is effective against the casemates or water-line of the very latest foreign battleships at 3000 yards. With six of these guns on a broadside the cruiser could certainly give a good account of itself, and as nearly all foreign ships have no calibre intermediate between six inches and the large guns in the main turrets, if our cruiser has sufficient armor protection to resist a six-inch shell, it can be injured only by the main battery of its opponent. It is, therefore, effective in drawing the enemy's fire, as well as in directly injuring him. It is noticeable, moreover, that the 8-inch gun can penetrate the turret armor of many late battleships at 2000 yards. A ship of this kind is a "battle-cruiser," not merely an armored cruiser. The latter term may mean anything; the former conveys the idea of a cruiser fit for battle, implying both guns and armor. This type is a fighting vessel and, therefore, in accordance with our necessities. At the same time the ship is as effective for chase, for blockade, for overhauling and capturing protected cruisers as any light armored cruiser could be. Phenomenal speed may well be sacrificed. Twenty-two knots is very high and, probably, all that will be needed ninety-nine cases out of a hundred. It is unwise for us to design for the hundredth chance, when the resulting ship will be unfit for battle.

The two armored cruisers we possessed in the Spanish war proved to be very serviceable. They are, however, too lightly armed to be duplicated and are also lacking in protection for personnel, which all recent experience shows to be most essential. They were not fitted for service in the line-of-battle when they were built, and are still less adapted for the work of a battle-cruiser to-day. The new cruisers of the Maryland class have been fully discussed recently in these pages and call for apparently but little commendation from the men who must use them. They are defective in that they do not have fighting strength commensurate with their cost, and are not adapted to any of the demands liable to be made on our navy. Their guns are too

small to injure a fighting enemy of smaller size; their armor is inadequate to protect the personnel against his fire. Their high speed is secured by increasing the length to such an extent as to cut down manœuvring power and render it impossible for them to act in company with battleships. Their speed will enable them to overhaul an enemy, but their low fighting power may render this a risky operation. There are very few docks which they can enter, and their operations, whatever they may be, are therefore limited in location. While fulfilling none of our requirements, they cost over four million dollars each and demand the service of a crew of over eight hundred men apiece. Have we either money or men enough to afford six such costly luxuries?

Fortunately, Naval Constructor Taylor's recent article directed the attention of the service to these vessels before they were really laid down, and there is plenty of time in which to change their guns and armor and vastly increase their fighting ability without interfering with their one good quality of speed. Such a change would render them of some practical service to the country, and it is wiser to face the problem now than invite disaster in the future. The country at large will consider these vessels as fighting ships, and will bitterly resent either their capture in war by a smaller but better designed enemy, or their obtaining safety by flight.

The St. Louis type is still more inferior. Her four-inch armor is penetrable by the six-inch gun at 4000 yards, while her six-inch guns are useless against the six-inch armor now so prevalent in foreign navies. There are many vessels of equal or even smaller size that could receive her fire almost unharmed, while their own guns could readily pierce her armor. In a battle of this kind the St. Louis would stand almost as good a chance of winning if she were armed with smooth-bores. The St. Louis is nominally a protected cruiser, and the money allowed is probably insufficient to give her the armor she needs, although she could be given heavier guns.

If we review our naval history since the Revolutionary War, and analyze the cause of the large measure of success we have attained in battle, I think any unprejudiced student will attribute it in great degree to the fact that we have made it a rule to have heavier guns in better ships than our opponents could bring

against us. We carried out this idea in the Minnesota class, the most powerful ships afloat in their day. Our first steel cruisers and battleships conformed to the same rule. If there is one principle that we have consistently clung to throughout the life of our navy, it is that of giving our ships the maximum of gun power. Even now, the acts of Congress authorizing construction of armored vessels always demand the "heaviest guns," or "most powerful ordnance" of the class of ship. Have our old traditions proved false that we are now violating them?

While advocating heavy guns, we must not too fully rely on the theory that a ship's best defence is in its battery fire. So it is within limits. If we believed it absolutely we would not build armored vessels. Santiago and Manila both showed the necessity of protecting the personnel. No amount of personal courage will enable a man to stop a six-inch shell with impunity, and no battery fire, however rapid and accurate, will avail for defence if the projectiles fired are too light to pierce our enemy's armor. The United States ought not to be called upon to pay three million dollars for any ship that cannot face a foreign ship of equal size and cost without a good chance of beating her. Given good fighting ships, it becomes the duty of the naval officer to get the maximum work out of them by training and discipline of personnel, but no effort can get fighting strength out of a ship unless it has been built into her.

If the general proposition be once admitted that all armored ships built for our navy should be designed for fighting in squadron, there still remains the question of the relative number of battleships and battle-cruisers. If fighting power is the prime requisite, why construct anything but battleships? The answer to this question involves the very existence of the armored cruiser. The type is in existence in all prominent navies of the world to meet the demands for work for which the heavy and slow battleship is but poorly adapted. Among these duties is scouting, chasing an enemy's scouts or cruisers, following and harassing a retreating armored fleet, detaining an unwilling enemy and bringing him to battle, chasing enemy's armored vessels attempting to break blockade. If these duties are to be performed against opposition, armor and guns are as necessary as speed. The Italians are attempting to build one type, which will efficiently perform these duties and also have full fighting

efficiency, but in all other navies there are two classes. This separation enables the fighting ship, par excellence, to receive the maximum armor and ordnance with moderate speed, while the cruiser should be given as high speed as is compatible with enough gun power and protection to enable it to be classed as an effective fighting unit. If any type is threatened with extinction it is not the armored, but the protected cruiser.

The answer to the above question cannot be given off-hand. Probably all officers would agree that we need more battleships than battle-cruisers. However useful the latter may be, they cannot rank in actual warfare higher than battleships second class, and there must be enough battleships built to meet our requirements for a powerful navy. While battle-cruisers may assist in a line-of-battle in a most material way, they can never take the place of the slower and heavier battleship. They are additional to it, not in any degree replacing it. In view of the fact that we are at present spending millions on armored cruisers of low fighting power, it seems that our immediate necessities are for ships that can fight, and what money may be voted for the next few years should go mainly for battleships. Three of the latter to one battle-cruiser might be a fair ratio for the present.

It is unnecessary to make any reference to monitors, as since the Spanish war naval opinion has crystallized against them. Of undoubted utility in harbor defence, their worthlessness at sea renders them a care and incubus in a fleet, and the best use to be made of them is to send them into port. Still, we can probably find use for those we have, and may even build others, but public opinion should never be allowed to consider them as increasing the fighting efficiency of the Navy. They are more nearly allied, so far as their usefulness is concerned, to permanent fortifications than to battleships, and while making excellent harbor guards, have practically no offensive power that can be brought to bear against an enemy at sea.

In omitting any consideration of the building of other ships for our navy than armor-clads, it is, of course, simply because it is outside the limitations imposed by our subject. A well-digested solution of a general ship-building scheme appeared in the last number of the PROCEEDINGS OF THE NAVAL INSTITUTE. Mistakes are less liable to be made in building small ships than in armored vessels, but the latter are so much more important,

more costly, and require so much more time for their construction that we can ill afford to make errors of any kind in connection with them. For this reason, this article is intended only to call attention to what seems to be the most vital point of our policy of construction.

As the final feature in the examination of our naval necessities is the very important question of how large naval forces we may be called on to confront. The general comprehension of the value of sea power, and the illustrations conveyed by the Spanish war of 1898 have led to a great activity in all the shipyards of Europe. Comparatively little attention has been bestowed on matters of military increase, while there has been a general building up of naval strength. It is a matter of comparative indifference to us how large European armies may become, as they cannot act against us, but we cannot remain indifferent to increase of naval force, as that may not only affect our interests unfavorably in many quarters of the globe, but may cause national disaster by defeating our fleet in war, and render possible blockade of our coasts or even invasion of our territory. We must, therefore, study the growth of all foreign navies to keep up a certain relative strength. This may lead to a competition in shipbuilding, but our resources fit us to enter upon this with equanimity, especially as under the law all money for shipbuilding is expended in our own territory, and the building of battleships stimulates many branches of trade and gives employment to thousands of men. The manning of a large fleet is another matter. Experience goes to show that we can obtain all the recruits we need, although at a much greater expense than would have to be incurred by any other country. This condition we must face and accept.

The direct comparison of the fighting strength of different navies is a matter of great difficulty on account of the widely different types of ships between which comparison is impossible. Some ships almost defy classification. The following table is probably approximately correct at least. (See next page.)

Several nations have adopted definite programs for naval increase, while others, like ourselves, vote new ships from time to time. Great Britain, which builds more than any other nation, is apparently still acting on the policy advanced long ago of maintaining her fleet at a strength equal to that of any two other

nations, and now has an exceptionally large number of ships under construction. This policy will probably be adhered to, and while it is therefore impossible to predict the size of the navy at any future time, it is safe to calculate on its always being greatly in excess of any other.

	England.			France.			Russia.			Germany.			U. S.			Italy.			Japan.		
	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.
Battleships, 1st Class	24	17	41	10	3	13	6	8	14	6	10	16	9	8	17	3	6	9	5	2	7
" 2d "	11	..	11	9	1	10	10	1	11	..	..	..	..	..	..	5	..	5	..	..	..
" 3d "	10	..	10	11	..	11	1	..	1	5	..	5	1	..	1	2	..	2	1	..	1
Total Battleships	45	17	62	30	4	34	17	9	26	11	10	21	10	8	18	10	6	16	6	2	8
Coast Defence Ships	9	..	9	8	..	8	3	1	4	8	..	8	6	4	10	3	..	3	1	..	1
Harbor " "	9	..	9	8	..	8	12	..	12	11	..	11	..	..	..	..	..	..	..	..	..
Armored Cruisers	12	22	37	10	14	24	11	1	12	4	3	7	2	6	8	4	1	5	6	3	9
Total Armored Vessels	75	39	114	56	18	74	43	11	54	34	13	47	18	18	36	17	7	24	13	5	18

The most comprehensive building program is that of Germany. It is advanced as a well-digested scheme of proportioning naval expenditure to national wealth, and although this involves considerable speculation and counting of chickens before they are hatched, there is but little doubt that the plan of construction will be carried on, whether taxation is increased or not, as the scheme of a large navy has been made popular throughout the country, and any extra burden involved will be cheerfully borne. We can therefore count with comparative certainty on the *minimum* strength of the German Navy for many years to come.

It is unnecessary to dwell at length on the plan of construction as it has been published to the world. A digest may, however, be of interest. (See next page.)

An inspection of this table shows that in the next four years (1902-1905), Germany will lay down eight new battleships, which, with the eleven now finished and the ten under construction, will give her a total in 1908 of 29 completed battleships, all but five of which are of steel. In addition to these, there are eight coast-defence vessels which are being reconstructed to fit them for general service at sea, making a total of 32 modern steel ships, and five additional ones of iron. This is practically the full

numerical strength of the proposed new fleet which is to include 38 battleships, and it is attained in 1908, instead of 1920, as the scheme pretends. In the next three years (1906-1908) four more battleships are built to replace an equal number of the iron vessels now in service. In 1909 there is one more new construction, bringing the total up to the figure of 38. The next six years see 13 new battleships built to replace old constructions, but some of the ships replaced are contemporary with the Oregon in our navy, and others are improved coast-defence vessels, and although obsolete in the eye of the law, will undoubtedly be serviceable in some way.

	Battleships. 1st class.	Battleships. 3d class.	Coast Defence.	Large Cruisers.
Finished Fleet, 1901	6	5	8	4
Under construction, 1901	10			3
To be laid down, 1902	2*			1†
1903	2*			1†
1904	2*			1†
1905	2*			1*
1906	2†			1*
1907	1†			2*
1908	1†			2*
1909	1*			1*
1910	1†			2†
1911	2†			1†
1912	2†			1†
1913	2†			1†
1914	2†			1†
1915	2†			1†
1916	2†			

*New ships in addition to present fleet.
†New ships to replace others legally obsolete.

The increase in armored cruisers is uncertain. The law calls for "large cruisers," and these may be armored or not as circumstances demand. Thus far good fighting ships, battle-cruisers, have been laid down. A point of interest is that during the years above noted (1901-1906), in which the greatest addition of fighting strength is made by the construction of new battleships, only one large cruiser is laid down each year, but when the battleship total is reached, two large cruisers are built annually. The first aim of the whole scheme is to get the fighting ships in service as soon as possible. After that old vessels can be replaced, the legally obsolete vessels being frequently serviceable. It is interesting to see on the list of vessels replaced in 1915 and 1916 the Furst Bismarck, Victoria Louise, Freya and Hansa, which have just been finished, and will undoubtedly be fairly efficient ships at the above dates.

The German scheme is an admirable one, and will give the nation a fleet which at all times will be in excess of the nominal figures. Unless Germany is to attain a predominant strength on the ocean, other nations, ourselves included, must build steadily. An average increase of two battleships and one battle-cruiser to our navy annually will preserve our relative standing; while two battleships and two battle-cruisers, or three battleships and one cruiser, laid down each year will keep us ahead in fighting strength. If we do not build we must, of course, accept any consequences that our naval inferiority may bring upon us.

The French have had one or two programs. The one now in force is designed to give France in 1907 a force of 28 modern battleships and 24 armored cruisers. This scheme does not involve a very large amount of construction. In 1901 the estimates are for two battleships and one armored cruiser. The French seem to be greatly enamored with the submarine boat and are laying down a large number.

Italy has evolved a plan extending up to 1910 for new construction. This provides for ten new battleships of about 10,000 tons each, besides the reconstruction of the Italia and the Lepanto. It is doubtful if this plan will be carried out. The latest ships designed are of 12,600 tons. The finances of Italy are not in such a condition as to warrant a very long look ahead in designing a plan for naval increase.

Japan has practically completed her building program of 1895 so far as large vessels are concerned. One new battleship and two armored cruisers are said to be projected.

Russia's program of 1898 provided for the building of eight battleships and eight "large" cruisers by 1904. Some of the latter were unarmored.

The following résumé shows the probable number of modern armored ships, excluding harbor-defence vessels, ready for service in 1905:

	United States.	Great Britain.	Germany.	Russia.	France.	Italy.	Japan.
Battleships, 1st class....	17	44	16	14	13	9	7
" 2d class....	..	11	..	11	10	5	..
" 3d class....	1	10	5	1	11	2	1
Total Battleships.....	18	65	21	26	34	16	8
Coast Defence Vessels ..	10	9	8	4	8	3	1
Armored Cruisers.....	8	40	8	16	24	5	9
Total Armored Vessels ..	36	114	37	46	66	24	18

Here our program ends, while that of other nations continues. Our Navy will probably be strong enough in 1905 to enable the foreign policy of our Government to be carried into effect, but not in 1908 unless further increased. It seems as though the country was confronted with the choice of two alternatives. One is to give up the Monroe doctrine and all plans for controlling an inter-oceanic canal, the other to increase our armored fleet at a minimum rate of four vessels annually, with proportional increase of personnel. If the second alternative is chosen, the contention held throughout this article, that all armored vessels built by the United States should be designed for place in the line-of-battle, is once more reiterated.

WASHINGTON, D. C., April 11, 1901.

Sir:—The Bureau transmits herewith a copy of a letter from Captain F. E. Chadwick, relating to the training of seamen. Captain Chadwick has consented to the publication of this letter in the NAVAL INSTITUTE, and the Bureau would be pleased to have it so published, and to have the INSTITUTE invite discussion of the same.

Very respectfully,

A. S. CROWNINSHIELD,
Chief of Bureau.

Secretary,
Naval Institute,
Annapolis, Md.

NAVAL WAR COLLEGE.

NEWPORT, R. I., March 29, 1901.

Sir:—I beg to be allowed to offer some views upon the methods of training seamen. My excuse for so doing, unsolicited, is due to my interest (which dates many years back) in the Training Service, with the inception of which and with the establishment of the Coaster's Harbor Island Station, I hope I may say without impropriety, I was somewhat closely connected; and in the great results of which, and its final establishment on a secure and (in my view) a proper basis, I have, as has every officer, a natural service pride.

2. While we have finally arrived at the great desideratum of beginning the training of boys in barracks, there is still involved in more or less discussion the method which should be adopted as to the early training afloat; whether this should be done in steamers or in sailing vessels. This question is unsettled in the

minds of many not only in our own service, but in the English, where of late it has been agitated in a very animated manner.

3. The subject goes to the root of the meaning of education, but is one which seems to me less difficult of solution in the case of boys trained for the navy than in the case of those who are educated ashore without particular aim as to their later life. In both cases education should, first of all, mean development in character; and acquirement of information be regarded as secondary. It is hardly to be gainsaid (though the fact is so largely lost sight of in our general educational systems) that character is pre-eminently what society regards as desirable to develop in youth. Granting this to be so in general, it applies with much greater force to the boy who is to serve at sea; who is not only to deal with the forces of nature in their elemental shape to a greater degree than the man following any other calling, but whose whole training looks to possible battle. It thus becomes a primal need to call out the more manly qualities as differentiated from those which tend to make him studious and bookish. He may have both; so much the better; but the first-named qualities of courage, resourcefulness, activity, strength, all those, in a word, which tend to make the naval seaman pre-eminently the "handy man," as he has been lately termed, must be first, and I have become convinced, most thoroughly convinced, that these qualities are acquired far better in a sailing ship than under any other circumstances. I thus think that the training of our boys after leaving the Training Station and before their transfer to the general service, should be in ships fitted with sails only, and with no steam-power whatever.

4. There does not exist in any life in the world, unless it may be in that of the Alpine guide, a school for the qualities mentioned, approaching in value the sailing ship. No boy, no man, can be in the habit of furling a topgallant sail on a breezy day, or of reefing sails in a gale, without acquiring certain qualities of the highest order, such as those mentioned. A lifetime's cruising in the steamer without sail will not give him such. And these qualities would be stamped on him in the sailing ship at his most impressionable age and during a period when the "information" part of education might well be allowed to lie dormant if necessary. But the fact is that a large part of the information he needs he can gather in the sailing ship as well as in an armored

cruiser. Most of his gun-drill would be the same; his small arm, his setting-up drills, the general work and life of the ship would be the same, and he still has years to learn the details of the battleship; details which he will absorb in a few months' time, consciously and unconsciously. He grows into this knowledge as much as by being trained to it, so that I do not believe at all in the necessity of his time being spent in the first part of his career in making him acquainted with details which will come later in a perfectly natural way or by the still later training of the seaman gunner and electrician. We want first and above all, the manly, courageous, handy and active man, and this being granted, I believe the natural corollary is that our training squadron should be one of sail only, with no steam and with no adjuncts which would bring the young sailor man less face to face with his great teacher—the Sea.

Very respectfully,

F. E. CHADWICK,

Captain, U. S. Navy.

THE SECRETARY OF THE NAVY.

DISCUSSION.

Captain CHARLES D. SIGSBEE, U. S. N.—Following the lead of the author of this letter, perhaps I may be permitted to present my warrant for an earnest interest in the matter under discussion. I have sailed on board eight sailing ships, seven square-rigged steamers and four steamers depending on steam alone. Of these vessels I have commanded four sailing ships and five steamers. My sailing commands were practice ships of the Naval Academy and one training ship for naval apprentices. I also was head of the Department of Seamanship at the Naval Academy for four years. Therefore, my field of observation has been rather broad and my experience of a kind to give me more than usual reason for cherishing a sentiment in favor of sail. I have that sentiment in large degree, but not as applied to the present needs of the service, for sail is dead in the naval service—dead beyond resurrection. For training purposes no more is claimed for sail, even by its most insistent advocates, than that it is the kind of gymnastics best suited to the Navy.

The majority of officers who advocate the use of sail for the training service admit that they desire to get the same kind of alert, handy and active men that we formerly had for topmen. In the days of sail it was held that it took longer to teach a man the trade of seamanship than any other trade whatever. If a man was made a thorough seaman and

topman in three years from the time of entering the service, he was an uncommonly adaptable man. The topman of the old days was a mature product, the result of years of training; he was an adult. Our present system is to train our naval apprentices for six months on shore and then add six months at sea. During the latter period sail exercise is the leading feature. He is then sent on board a mastless ship where all sail exercise must necessarily cease. He is not a finished seaman, nor has he become ingrained with the habit of the sea, which is a quality much dwelt on. He is only a lad. We do not now get the old-fashioned sailor by means of sail in the training service, nor can we get him without expending an amount of time on his training that cannot be spared. The desideratum at present is to train more rather than fewer apprentices. With the same facilities we can train twice as many apprentices by making the course one year as by making it two years.

I have heard officers assert that "the best place to make a sailor is on board a sailing ship"; that is a phrase and not an argument. Its value depends on the kind of sailor we want. If we want a sailor, or to use a better term, a "seaman," who is seven-tenths soldier and mechanic, then the best place to make him is not on board a sailing ship. The kind of man that we should desire in the naval service is precisely the kind of man that we need to carry on the duties as they exist at the present day. It would not be thought necessary on shore in hay-making to keep a man at the old-fashioned scythe for six months in order to educate him up to a seat on the mowing machine.

Sail exercise carries with it much of the "helter-skelter" and "bully boy" spirit of the old days. It makes a *horny-handed, stiff-fingered* man instead of a *soft-handed, limber-fingered* one, and the latter is what we now need. It was a sight in the old sailing days to see a topman write a letter. He was a fine fellow for his period, but he handled the pen with about as much dexterity as could be expected from a parrot or an eagle.

Sail seamanship involves the use of about the clumsiest and most hand-hardening mechanisms to be found anywhere, whereas the modern mechanical details of shipboard in the Navy are, as a rule, exceedingly delicate in comparison. The kind of nerve and action needed at the present day differ widely from the reckless kind needed in the days of sail. If the use of sail for training purposes were to lapse for a year or two nobody would dream of going back to it. I am inclined to believe that much of the objection to the abandonment of sail exercise comes from a vague fear that something valuable will "go by the run," without adequate substitute if we relinquish it. If we were to abandon sail exercise we would thereby gain much time which might be devoted in large part to that kind of instruction which is now given at the Torpedo School, Gunnery School and Gun Captain School.

While in command of the training ship Portsmouth I always felt, when inspecting a new draft of apprentices, that I could point out initially a large number who would not remain in the service. Many came because of romantic ideas of the sea and sailing ships. Others came because

their parents desired them to escape rather undesirable associations, and these lads were willing to enter the training service because of the same romance of the sailing ship. Such lads conceived that sail exercise was the dominant thing on board the training ship. They were always better at that exercise than at anything else. All drills with arms were discounted. A number deserted and comparatively few remained in the service after sea experience had stripped their conceptions of romance. An officer once said to me in those days, " The training service acts as a decoy for boys. When they find out that they are decoyed they leave." If sail drills were abandoned and modern drills substituted therefor, the preconceived notions of young apprentices would meet with much less violence. The setting-up drill as taught at the Training Station is better as an exercise in producing a well-balanced physique and serving for modern purposes than sail exercise; very much better; but unfortunately it is not taught nearly so well in the general service as at the Training Station. There is no other drill known to me so well calculated to produce good concerted action and to enchain the attention of considerable bodies of men to the drill-master. It has had more to do, in the service at large, with making petty officers drill-masters than all other causes combined. That exercise, if properly conducted, together with the routine duties of shipboard and with boat exercise in larger degree than at present, would suffice to keep our crews in good muscular form. Pulling exercise in boats is sadly neglected in the service, through the habit of using steam launches. During the last fifteen years of observation I have rarely seen a single-banked boat of the United States Navy under way in which some of the crew were not pulling breast-stroke and others side-stroke. I have called attention to it very many times and have tried to correct it in my own commands. I should like to digress enough to say that side-stroke is a fancy stroke which has no place in the service in this day of prompt utilities.

I desire to refer to another point, although it is only indirectly connected with the letter under discussion. The question has often been brought up as to whether a naval apprentice should have a considerable period of instruction on shore before going on shipboard, or should be embarked at the outset, or after a very short period on shore. I have held in the progress of conversational discussion that all arts are kindred as to methods of instruction. The art of the man-of-war's man should be no exception. In every other art the person under instruction begins with the easiest or most elementary principles, under the easiest or most favorable conditions, and advances step by step toward the greater difficulties and the higher practice. A lad suddenly thrust into man-of-war life, without previous training, is confronted with sanitary conditions of which he is ignorant, with a complex terminology, routine and construction, and also a multitude of duties and an all-pervading and rigid discipline. He flounders, drifts with the tide, and becomes careless and discouraged. In my opinion shore practice should be given until nothing is left to be learned by an apprentice except those things whereof the ship must essentially differ from the Training Station. The weeding-

out process should take place on shore to the fullest practicable extent. One would not begin to train a newly formed regiment of volunteers in the mud, or suddenly subject the recruits to regimental manœuvres. On the contrary the men are divided into small squads, which are put under instruction conjointly in charge of non-commissioned officers. Each man therefore receives more individual attention and his personal qualities are better known. Herein we have analogy with instruction in other arts. In the Navy we have always drilled men in too large bodies at the outset.

If there are any advantages of sail in the training service they apply also with some force to the Naval Academy; therefore, I may be permitted, perhaps, a slight extension of view in the direction of the Naval Academy. I believe that the continued use of training with sail is not only of doubtful benefit to the service, but that it is very harmful. I have held this view for many years. As against all former argument we find the steamer now forcing its way into the training service and into the Naval Academy through the mere pressure of logic. The retention of sail has hurt the Navy in Congress. Although officers, for a long time, have attached importance to sail seamanship only in its application to the Naval Academy and to the training service, many members of Congress assume that officers believe that sail seamanship in large degree constitutes an important part of the seamanship of the general service; hence it was sometimes declared by members of Congress that seamanship had gone to the engine-room. Now that the engineers have been absorbed into the line it is probable that we shall hear no more about seamanship having gone to the engine-room.

Various arguments are presented from time to time as to the continued need for sail instruction at the Naval Academy. One is that the cadet is thereby fitted to bring sailing prizes into port in case of war. A young officer a few years after graduation is no more fit to sail a sailing ship than a young lawyer is fit to manage a difficult case, or a young doctor to take charge of a difficult case, under a similar condition of lapse of practice. Practice subsequent to graduation is absolutely essential to make a sailor for sailing ships. Moreover, sailing prizes will probably be destroyed at sea.

During the four years that I was head of the Department of Seamanship at the Naval Academy, I was continually hampered in my desire to progress in the program of studies by a persistent insistence on the importance of sail. In certain influential directions it was even then asserted that our cruisers should continue to carry sail. This was from 1887 to 1891. It was argued in favor of practice with sail that it prepared the cadets to "meet emergencies." Here is how it really worked. The first-classmen of cadets took charge of the deck on board the sailing ships only on one practice cruise of three months, or 90 days. They alone of the cadets had anything to do with control in emergencies under sail. Assuming the first class to have had thirty members, for the sake of argument, and each one to have had an equal amount of deck duty, none could have had more than three whole days, or 72 hours,

with the trumpet in hand, one of which days, owing to the itinerary of the cruise, must have been in port. Now think of the waste of time in study and practice in old seamanship during the whole Academic course, to lead up to this result so far as emergencies were concerned.

Again, while in charge of the Department of Seamanship at the Naval Academy, I desired to modify, in greater degree, the instruction in seamanship to conform with modern practice. In order that I might have proper authority and also that I might know what I was expected to teach, I presented a resolution to the Academic Board, declaring substantially that the term *seamanship* was meant to include the care, preservation, organization, direction, equipment, management and behavior of our naval vessels, under all conditions of weather, sea and tide, at sea and in port. My resolution was tabled, chiefly because of the influence of sail seamanship at that time. I had intended, when I took charge of the Department, to write a book on seamanship on new lines. It was my purpose to treat of mechanical appliances on shipboard in much the same fashion as elementary appliances are treated in text-books devoted to mechanism, instead of mixing up appliances indiscriminately with evolutions, orders and routine, as found in existing books on seamanship. In fact, most books on seamanship have been made up largely of the fragmentary experiences of seamen from the beginning of time. I had also intended to draw from books on naval architecture for the qualities of ships as based on their construction, and for their management and behavior under the damaged conditions of battle. I received so little encouragement from any source that I was obliged to feel that in writing a book I would only have my trouble for my pains. Therefore I abandoned my purpose, as I have always believed, chiefly through the operation of the opinions of other officers who favored the retention of sail exercise as a matter of great importance.

As a rule we are slow to abandon established ways and things. We are more willing to adopt things entirely original in respect to application. The patent capstan—chain direct to the capstan—had a hard fight to gain its place, so had metal straps, slings and rigging. Steam was resisted long and earnestly. Sail in large cruising ships forced its way into the new steel navy—even into the design, at least, of the old Maine. Smooth-bore guns made our wooden steamers museums of antiquity long after every other nation had abandoned smooth-bore guns. Metal for ships' hulls had a hard wrestle with wood, and so had steel with iron. Until quite recently it was desecration to use any other than white and black paints on board our men-of-war. Why was it that the principles of ornament and decoration collapsed at the beach? Several years ago, in the hope of sympathy for my side, I complained to one excellent officer that another excellent officer had prophesied that sail exercise would be the gymnastics of the training service for fifty years. "Yes, for one hundred years," was the response. Verily the route of the reformer is full of snags.

The opinions that I have stated I have expressed frequently during the last fifteen years. My views are certainly much nearer realization now than they were fifteen years ago.

Before closing it is perhaps well to call attention to the fact that the environment of the naval apprentice on board a sailing ship or a square-rigged steamer is not the environment of the general service. He is associated with antiquities in every direction, and he is using up time which should be largely expended in acquainting himself with the complex details of modern construction and with modern shipboard terminology.

Captain C. H. DAVIS, U. S. N.—I am tempted to offer a few words in support of Captain Chadwick's argument, not because I can improve upon it, but because I have always been an advocate of a sailing-ship training for both men and officers, have, perhaps, had an exceptional early experience in sailing ships, and have commanded a squadron of cruising training ships. I have very pronounced and distinct ideas on the subject of training by sail.

I believe I am familiar with the arguments used against sailing-ship training. I believe most of these arguments to be unsound. My own experience with legislators leads me to believe that because an officer advocates a training fleet of sailing ships for apprentices he is not in any danger of being understood as an advocate of sail-power for modern battleships; and that it is comparatively easy to convince the intelligent legislator that a sailor may be produced by taking the apprentice to sea in a sailing ship, while it has been somewhat difficult to induce him to believe that a raw lad may be taken off a prairie farm, trained in a barracks, and graduated a seaman. To say that in the four years course at the Academy a cadet gets only about three hours actual experience with the trumpet hardly tells as strongly against the sailing ship as against the Academy itself. As to the question of environment, the sea itself is after all the environment of the seaman. Therefore that which tends to accustom him the most readily to the sea is the best medium of early training. It is a familiar truth that the sailing-ship officer and the sailing-ship seaman are good in anything that swims.

I approach this subject with some hesitation because I am by nature conservative. I dislike change for the sake of change. But I believe that that sentiment of conservatism, which has been general in the service, and which has been made the subject of criticism, was the very force which carried us through the disastrous years of decadence following the civil war, and fitted us for the great changes which were to come when the Navy was to be rebuilt in steel. Admiral Porter was much derided for rigging every gun-boat with full sail power, for we had the advocates of mastless ships even in those days. But that sail power carried our old black hulks to every sea and station, and kept the service and the spirit of the service alive when it was an alternative between sail and extinction, when few cared whence or how we came or whither we went. The service cannot justly be accused of an opinionated resistance to modern conditions when a change to such conditions became possible. I do not think that is a just charge against a service which has from its very beginning led the way in improvement and innovation, whenever it was possible and profitable to do so.

Now no better or finer man was ever produced, either ashore or afloat, in any sphere of life or in any time, than the sailing-ship seaman. He existed because conditions justified and demanded his existence. He can be produced again only under conditions which shall again demand him. Therefore it were senseless to expect to revive the sailing-ship seaman and make him that and nothing else. But the best traits and the best qualities which he had can be revived by an early training which shall assimilate to the old conditions, provided that the service at large is bent upon it and determined that this is the best way of commencing the training of a seaman. I insist upon this as a *sine qua non* of a revival of training under sail. It must be done in dead earnest, and with the firm conviction that such a system is the best possible school for seamen, or it had better be let alone.

If the so-called training ships are to be towed in and out of port, if they are to be crippled with double topsails, shorn of one-third of their sail power, filled with appliances and machinery which will take them in tow in distress, illuminate them with electric lights like an excursion steamboat, or an army transport in the presence of the enemy, keep a steady stream of distilled water trickling in every apartment of the ship—in other words, if the displacement which should go to power and efficiency as a sailing machine is wasted in labor saving and luxury; and finally if these ships are to be manned for a few months in the pleasant season with a timid and awkward crew of landsmen, under officers whose experience with the trumpet is limited to three hours in four years, we may not look for a very large output of hardy seamen. The seaman cannot be raised as an exotic, nor grown under glass.

Up to 1888 or thereabouts we continued to maintain our squadron of sailing ships for apprentices. I commanded one of these, and by virtue of seniority, the squadron of three. We cruised constantly in company for two years. I believe no better, quicker or more efficient system of training for boys, and incidentally for officers, ever existed. It was deliberately abandoned when there was nothing better to substitute than a brick building. It could be revived if the service were so determined. One thing that impressed me most strongly in this system was the rapidity with which it worked. At the risk of garrulity I venture to recount an incident of that cruise. While the ship was lying in Hampton Roads a young ensign just promoted reported on board one morning for duty. He was assigned to deck duty immediately, had the afternoon watch, and at one o'clock the ship was got under way to beat out with the ebb tide, the wind being fresh at S. E. The tacks were no sooner aboard than she went about, the executive officer being still on deck. Then the trumpet was handed to our young friend, who had had just the required three hours previous experience, and almost simultaneously the order was given him to tack again. I stood behind him on the horse-block and coached him—put the words of command into his mouth. From a state of extreme nervousness his confidence awoke when he saw how easy it was when one knew how, and when he realized that a trained and eager crew was his own to command, boatswains mates his lieuten-

ants, and a mighty and complex machine his plaything. The second time we tacked close under the Thimble Light, and he hardly needed coaching at all. A word when to haul the main-yard was about all. When that young man turned over the deck at four o'clock to an old lieutenant, he felt himself his equal, and a new man. Four hours on the deck of a sailing ship had changed him. I cannot bring myself to believe that such lessons are futile, or that they might not be revived with profit, if the service so willed and determined.

Commander W. J. BARNETTE, U. S. N.—I can add nothing to the force of Captain Chadwick's reasoning, for his conclusions are sound. The stock argument against the sailing ship training is that it is a great waste of time, and that there is so much to learn no time can afford to be wasted.

As a sailing ship tests all the faculties of the seaman to the fullest extent, that system surely cannot be time thrown away. I venture to say that none of the older officers who have had more or less square-rig sailing will be found on the side opposed to this system of training. Opposed to it would be those whose opinions had been formed from their practice cruises—an experience too limited for forming a sound judgment. Who then should be considered best able to judge as to the system of training which will produce the best results—those who have served both in the old and the new or those who have had little but the new?

I have yet to hear any one say that the commanding and executive officers of our new ships have been unequal to their duties because of their early training in sailing ships. When an officer feels that he has mastered a sailing ship there is nothing in the new Navy that will shake his confidence in himself or cause him any great amount of worry.

The English officers are evidently still divided on this subject, though on a recent cruise to the West Indies I had the pleasure of lunching with three English captains who were unanimous in saying that if they had the selecting of their first lieutenants they would always prefer those who had been through their training-brigs.

An officer who recently left the "Saratoga" for duty on one of our steamers bound for Manila wrote me in mid-ocean that they were struck by a heavy squall and all he had to do as officer of the deck was to haul over the hatch-hoods and send for his raincoat. That simple statement tells a whole story to those who know a sailing ship.

If the sailing ship be so valuable to an officer it must be in a like degree to the seaman. I say with Captain Chadwick, by all means give us the square-rigger for training both officers and men.

I am very glad to note that the Department is following this system so far as lies in its power.

Lieut.-Commander A. C. DILLINGHAM, U. S. N.—In considering the paper written by Captain Chadwick, relative to the training of seamen, I beg to state that I agree entirely with Captain Chadwick's views.

I have had the advantages of having served aboard a sailing training ship, and of being executive of a battleship where I was able to compare the worth of a sailing ship, with steamboat training.

Training on a sailing ship develops the lad's mental resources, gives him independent thought, with a habit of looking at things aboard ship with a sailor-man's eye. It develops the faculty of considering more than one thing at the same time, exercising the mind in such a way as to broaden the nautical intellect; it gives ship and sea habit in a way that no other service can do, and a lad brought up on a sailing vessel has his nautical faculties so developed that he is away to windward, in his efficiency of work aboard the modern man-of-war, of the lad who has not had this nautical training. In the modern man-of-war, the lad is lost to everything but his own particular part of the ship; he may be shifted around from one part of the ship to the other, but he has not always before him the whole ship, as he has in a sailing vessel, where in working his part he sees the working of other parts—this gives greater freedom of thought in a greater view, a broader sphere of thought, which without effort on the lad's part, develops or educates the mind and takes him to a modern ship much better developed in character, for efficient service in his fighting sphere.

On a sailing vessel the lad acquires the habit of going from one thing to another to get a result—from clewlines to buntlines, from after braces to the head braces, for instance.

By this habit he is better prepared for service on the modern ship, where in fighting service he must go himself instead of having to be led.

The difference between a sailing-ship-trained lad and a steamboat-trained lad is very apparent aboard our fighting ships.

The sailing-ship-trained lad will rig a coaling derrick, reeve off and lead out the fall, where the steamboat-trained lad waits to have the fall put in his hands.

He has an alertness and a quick perception; he is a "handy man" from the boat crane or coaling derrick to the mechanism of a machine gun. In the turret he shows the good results of his nautical training on the sailing vessel, by his quick perception and alertness and readiness to adapt himself to circumstances.

You will find sailing-ship-trained lads who can drop from the smoke hatch of a turret to the handling room below, opening always the proper valves as they go down, displaying the faculty acquired on a sailing ship, of being able to look ahead, of considering at the same instant, the parts necessary to make the whole.

Training on a sailing ship develops the lad, physically and mentally, broadens his perceptions, gives him self-reliance and courage and broader views, alertness and nimbleness, that will stick to him forever, no matter where he may serve.

He has acquired ship and sea habit more permanently, and sooner, than he could have done on a modern fighting machine.

To make a sailor he must go to sea, and I believe that sea service on a sailing ship has innumerable advantages over steamboat training.

Aboard of a sailing ship there is always the working of the ship, if it is only the trimming of sails that keeps the minds of the men on deck occupied with thoughts of their profession and keeps up an interest which becomes lasting, and in its effects, trains the mind to alertness and interest in seaman-like doings.

This is always the case, so long as the sailing ship is under way, but in the steamer far different, after the anchor is fished, there is nothing of interest, so far as the movement of the ship is concerned, and the lad under training lapses into idleness and laziness, both of body and mind, to be aroused only by a call to dump ashes or to trim ventilators.

These qualities, "courage, resourcefulness, activity and strength," developed in training on a sailing ship, are all elements that make up the character of the man we need for seaman.

Rear Admiral W. C. GIBSON, U. S. N.—I have read with great interest the paper by Captain Chadwick, U. S. N., sent to me for "criticism and opinions."

I agree with the author in all that he says in favor of training boys in sailing ships. In my opinion there is no school like it or equal to it.

I cannot say that I would go so far as to banish the steam engine entirely. In my own experience in command of a training ship I found it exceedingly useful in reaching port after a cruise which had been lengthened by unfavorable winds. I believe that in a training ship, steam should only be used for entering and leaving harbors.

In ships having steam power there are facilities for instructing such of the apprentices as are so inclined in the duties of the engine and fire room.

Lieut.-Commander J. B. MURDOCK, U. S. N.—I most fully agree with the views expressed by Captain Chadwick in his letter. There is nothing like cruising under canvas to develop the resourcefulness and general usefulness we so much need in our service. There are plenty of chances given for training specialists, and developing a man's capacity in one direction, but a general fundamental training in the seafaring habit cannot well be obtained either in barracks, workshops, or even aboard our men-of-war. As the best college training aims at a general development and broadening of the mental faculties as a preliminary for future special work, so our naval training will be better if it rests at bottom on the acquisition of the seafaring method of life and thought which has characterized good seamen since commerce began. And if apprentices acquire this early in life, they will be vastly better men for the service. I have always believed in the barrack system as affording the best means for rapidly breaking the recruit into discipline and to habits of obedience, but it needs a supplement afloat, and nothing seems so well adapted to give what is needed as the sailing ship. When the apprentice then enters the general service he comes with the broad foundations of his training well laid, and is fitted for any special training for which he may show aptitude.

Lieut.-Commander E. B. UNDERWOOD, U. S. N.—Captain Chadwick has done the service a good turn in emphasizing the necessity of sending our apprentices, for their preliminary training, from the training station to a sailing training ship, rather than to a steamer.

During this formative period of their lives, it is my opinion that they will derive much more benefit from a cruise in a sailing vessel—a square-rigger—than from one in a steamer. After they have been transferred to the battleship or the cruiser, they are not too old to learn the part of their technical education that cannot be acquired on board a sailing vessel.

What quality is more desirable in a man-of-war's man than that called "contempt of danger"? It must be obvious that this hardihood can better than anywhere else be acquired by drills aloft in all sorts of weather in a sailing ship. For physical development, too, how far ahead are the drills aloft when compared to the ordinary "setting up" drill of mastless vessels.

There is another point that ought not to be lost sight of. We hear that the aggregate tramp steamer tonnage is ever increasing, but it will be many years before the sailing freighter is driven from the sea. If, then, we should engage in a war with a power having a respectable merchant marine, it is fair to infer that we should find some sailing vessels on our hands as prizes. Great, in that case, would be the necessity of having for prize crews officers and men skilled in the management of sailing vessels. It ought to be plain, then, that, for educational purposes, our sailing training ships are especially valuable, for the young officer as well as for the apprentice.

In connection with this subject, I would like to call attention to the desirability of having the petty officers and seamen of the training ships picked men, men that are sailors, not in name only but in reality.

During the past two years I have served successively in the training ships Alliance and Topeka. The former, long time in commission, had a most capable crew, one that it was a pleasure to serve with. The Topeka, on the contrary, newly commissioned, had a crew many of whom were not sailors at all but "steamers" (if I may be permitted so to use this word). Their service had been entirely in steamers and they knew nothing about the duties of a seaman, in the meaning given to the word a generation ago. In the sail and spar drills of the early part of the cruise, the attention of the officers had to be occupied, in a large degree, with petty officers and seamen aloft, and to that extent the landsmen for training were sufferers. It would seem to be feasible to anticipate by a few weeks or months the commissioning of a training ship, in which time it ought to be possible to collect on board the nearest receiving ship, either by enlistment or by transfer from the vessels of the fleet, men who are, in the proper acceptation of the term, seamen.

By all means, then, let our apprentices be given their early training in sailing vessels, and let these sailing vessels be given the right kind of crews.

Lieut.-Commander W. F. FULLAM, U. S. N.—It is most unfortunate for the Navy that the modern ship has been habitually referred to as a mass of complicated machinery, a floating fort, an arsenal, magazine, and machine shop combined. Quite naturally, the people at large, who look at these "awful monsters," these "fighting machines," with open-eyed wonder, jump at once to the conclusion that the men to man and fight them should no longer be trained as sailors but rather as machinists, gunners, and electricians. And not a few naval officers, actuated by a praiseworthy desire to keep pace with naval development, have been driven by the seeming logic of events to advocate a machine-shop training for men-of-war's men! Others, while not failing to realize that in passing from the sailing frigate to the battleship there must necessarily be a change in the education and training of the man-of-war's man, are not so far deceived as to favor the practical abolition of sailors in the Navy.

Captain Chadwick's treatment of the subject is most happy in that he distinguishes between the "development of character" and the "acquirement of information" in the training of seamen. And this very sensible view of the matter, which does not ignore the machines, the guns, and the dynamos, may serve to allay the fears of many zealous up-to-date naval officers, who, in their anxious opposition to all conservative influences, condemn the sailing ship as a relic of antiquity and an unfit place to train recruits for a modern navy.

Captain Chadwick strikes a "happy mean." We need not continue to produce sailors of the old school, and we need not confine ourselves to machinery, and to things mechanical in the training of landsmen and apprentices. But we should, by all means, endeavor to develop and retain that "handiness," physical activity, fearlessness, and quickness of the eye which distinguished the old time sailor—qualities which can be bred nowhere so surely or successfully as in a full-rigged sailing ship. In short, let us keep all that is *good*, get rid of all that is *bad* in the sailor, and *add* the military and mechanical education that is necessary to efficiency.

The "development of character," as Captain Chadwick puts it—the preliminary physical and mental drill, the strictly seaman's training which gives us a quick, athletic, handy, all-around man—need not continue longer than a year if we are pressed for time. *Then* we may send the graduate to a modern cruising ship for the "acquirement of information" during the remainder of his career. He will quickly learn to handle machines and guns, and when called upon to man a boat, sling a stage over the side, shin up a signal mast, or *handle himself* generally in the daily routine of a battleship, he will be found superior to the machine-shop product every time. The moral effect of even six months training aloft in a sailing ship will be lasting and invaluable.

It is sincerely to be hoped that Captain Chadwick's solution—develop character, activity, handiness and fearlessness, *first* in the young naval recruit, and then *finish* his training with machines and guns—may be acceptable to all officers, for it marks out a neutral ground upon which

the conscientious advocates of two opposing theories can safely and unitedly stand for the accomplishment of a common purpose.

Lieut.-Commander W. L. Rodgers, U. S. N.—I agree entirely with Captain Chadwick's views when he says that the old-fashioned training aloft in sailing ships produced handy, resourceful and courageous men, developing character such as we need now. I doubt, however, whether we may hope to produce such men by the old methods in the present day.

In the first place, the newspapers throughout the country have been assuring the public in general and the Naval Committees of Congress in particular that the man-of-war's man of to-day is a product of education and environment altogether different from the heroes of Marryatt and Cooper. The seed has fallen on good ground, and is bearing abundant fruit. I understand that when the Navy Department urged appropriations last year for sailing craft for the training squadron, it was found impossible to make any impression on Congress, and I do not believe it can be done hereafter. Our spars will last no longer than our present ships can carry them. For a congressman does not readily see that a good royal yard man is particularly fitted to handle an electrically controlled turret. The idea does not fit with his preconceived notions of business and life.

In the second place few of the officers and none of the petty officers and men who now serve as instructors in the training service have served on a smart sailing ship of the old type; they are not expert themselves in what they are expected to teach. Moreover, all the younger element, including officers, men and apprentices, look on spars as something obsolete, and have no appreciation of the lessons which may be gained from drill aloft. Therefore nobody takes as keen an interest as was formerly the case.

Thus the best efforts of captain and executive cannot develop that liveliness and promptness which was the rule years ago when sails were still a live issue.

To try to maintain a sailing squadron is to fight against the stars in their courses. When the lieutenants of to-day reach command rank it is certain that they will abjure sails and any effort to prolong their existence in the Navy will only make the transition more embarrassing when it is suddenly forced on us by the retirement of our present wooden ships; all of them already old.

These considerations make me willing to accept mastless ships for training that we may learn how to get on when we have no other means of dealing with recruits.

We must find out how to make modern drills produce the activity, resourcefulness and handiness which spar drill once did, but which none of the younger officers now know how to utilize for this object. Let us then devote our efforts to boat drill, under oars and sail, to infantry; to mining and countermining, as well as to great guns and target practice; and if in no other way, the service will benefit by better health and endurance than is usual at present on mastless ships. Any one going from a

training ship to a mastless one at once notices the clearer complexions and heartier appearance of the recruits under training.

The drills just mentioned have never been developed to the utmost in our service, but if they should be, there can be no doubt that the resource and intelligence of the crews would be developed to a great degree, even if not so highly as with masted ships. In boat work exercises under oars and sail in all weathers should be the rule in port and at sea. When near good beaches in warm climates the whale boats should land through the surf when not too rough, and at sea "abandon ship" should frequently be carried out, making sail after shoving off. Infantry drill should include target practice, when advancing in open order, together with tactical work in the field, embracing scouting and manœuvring against opposing forces. In this way much may be done to develop intelligence and readiness. Laying dummy mines and operating against them by dragging and sweeping is a fine exercise in seamanship.

Altogether, I think, modern drills offer very nearly as good a field for development of character as the old ones, after we shall have had a little experience in utilizing them for the purpose. Besides they offer the great advantage that people think them useful and modern and so take an interest in them which is lacking with sail drill.

It is unfortunate that with a force inadequate to man all our ships, we find it advisable to absorb such a large percentage of it in training service.

My observation, both of apprentices and landsmen under instruction, leads me to believe that the principal training they pick up is in the way of obedience, good manners, cleanliness of person and of clothing, together with a general idea of ship's routine. Their knowledge of seamanship and other drills acquired at the same time is secondary in importance to their development of habits and character. I am of opinion that six months at a training barracks by the sea would teach them all this nearly as well as if they were afloat. Then they should be transferred to the larger ships in regular service and take part in all the ship's work and exercises until noon. In the afternoon there should be special exercises for recruits and this instruction should be regular and progressive.

In this way the greater part of the force employed in the training ships would become available to commission four or five battleships; for comparatively few officers and petty officers could manage the barracks, some of which exist even now.

Our seamen who fought in 1812 were as good as any; and they were trained in regular cruisers without any special training ships, and we can do as well now.

The only difficulty is that it would be necessary for the Department to make an effort to see that every ship carrying recruits for training really does give them the necessary attention.

This is a real difficulty; for it must be acknowledged that the Department's methods of control of ships afloat, except in matters of the purse, are not yet perfected.

It is interesting as a matter of history, to note how for a hundred years the Department has been making earnest efforts to increase its

authority and control in matters of routine and administration, and how unsatisfactory are the results so far accomplished.

The reason undoubtedly is that it has tried to rule too exclusively through regulations and correspondence, when it is absolutely necessary to keep in touch with the Navy and establish effective supervision by personal inspection through a body of officers detailed for the purpose and reporting direct to the Department as does the Inspection Corps of the Army.

Lieutenant GEO. R. CLARKE, U. S. N.—Captain Chadwick has done good service in again calling attention to that most important subject, the training of men and boys. In the close attention given to modern appliances and equipments, electrical and mechanical, it is well not to overlook the importance of this branch of the officer's education, the study of the men collectively and individually, with a view to getting the best out of crews on board our ships. A neglect of this study results in waste of material, so to speak, in "rubbing men the wrong way"; in having a disgruntled, dissatisfied crew in whose hands the best equipped ship is inefficient, or, at any rate, not at her best.

I think that the training ships should have auxiliary steam power to enable them to enter and leave port, and to better follow a pre-arranged itinerary. All the benefits of sail drill can be had in the long stretches at sea. The manœuvre of entering and leaving port is a drill, not so much for the boy as for the officer. Then, too, it is important to keep the boys in a cheerful frame of mind, as free from discouragement and disappointment as possible. Those who have been in the training service know that after a quick passage across the Atlantic, an unfortunate shift of wind may occur and keep the ship out as many days as she has taken to make the run from port to port. This has a most unfortunate effect upon the boys, and they are the ones we are considering.

Again, while it may be regarded as providing for a remote contingency, it is yet worth while to consider the possibility, in these days of "war's stern (and sudden) alarums," of a training squadron being caught out, an easy and tempting mark for the enemy's cruisers. With steam power they would be far less helpless. I know that this part of the subject was often a matter of discussion on the practice cruise of '97.

Lieut. JOHN M. ELLICOTT, U. S. N.—I am glad to be permitted the opportunity to express my hearty agreement with the views of Captain Chadwick as to the training of seamen.

If action is taken in accordance with these views, however, we should guard against the natural economic inclination to rehabilitate old sailing vessels, or old type vessels which might be converted into sailers, for training purposes. Resourcefulness and handiness in the sailor need the incentive of *esprit;* and the latter should be cultivated as much as the former qualities. Sailing ships for the training of seamen should not be improvised from old material, but should be newly constructed with a view to making them excel in speed, handiness, weatherliness, and modern

comforts anything of their class afloat, so that those who man them may take pride in their superiority and feel impelled to put forth every effort to maintain it.

I would suggest in connection with these remarks, that it might be well to have our Naval Attache at Berlin inspect the Grossherzogin Elizabeth now completing under the supervision of the German Training-ship Society for the training of sailors for the German Merchant Marine. I suspect that on a somewhat larger displacement, and with a battery, she would be about what we need.

Lieut. J. L. JAYNE, U. S. N.—Since the Chief of the Bureau of Navigation and the Institute have invited discussion of Captain Chadwick's letter, I presume that a general expression of opinion is desired, and I therefore take the opportunity of casting my vote for the preliminary training of apprentices in sailing ships armed with modern guns, because I believe that there is no better way of developing certain qualities which our modern seamen should possess, because much of the knowledge thus gained will be useful to them in any ship and their minds are thus trained to readily grasp the particular duties required on any ship, and because such a large percentage of the merchant tonnage of the world is propelled by sail that I think it desirable that our seamen should have knowledge of that method of propulsion.

I think it desirable to equip training ships with auxiliary steam power to operate dynamos, ventilators, etc., to contribute to the comfort of their crews. Since the rapid development of seamen will require the ships to be much of the time at sea, every effort should be made to make the life attractive and thereby save to the service many valuable boys who might become discontented if not provided with means of enjoyment. I do not mean that discipline should be relaxed. On the contrary, I believe that it should be strict, for if apprentices are not properly trained in this respect they are apt to give trouble in the future.

I think that the officers for this service, and especially the commanding and executive officers, should be carefully selected, and, if possible, only those who are interested in it detailed for it.

Lieutenant A. A. ACKERMAN, U. S. N.—Captain Chadwick's letter is a strong appeal for the development of character in the young apprentice. The acquirement of information is to be regarded as secondary. The qualities of courage, resourcefulness, activity and strength are grand ones. They not only make the "handy man" on board ship, but they make the *man* in the highest physical sense, no matter what his vocation.

There are those, however, who question the fundamental proposition: Do we want Jacks-of-all-trades and masters of none on modern cruisers and battleships? Don't those people often go to sea because they can't get along on shore? Isn't the capacity of the old salt for bungling when he "overhauls" a modern gun mount, truly appalling? Are even the officers, prepared as they are in theory, able to absorb all the details of a battleship in a few months?

It is well understood that gymnastics develop courage, and none are more healthful than sail and spar drills. It is also agreed that the knowledge of routine work on sailing vessels is of value to all who go to sea; as a preventer if for nothing else, but in this case there seems no good reason for reeving off the preventer before any other rigging is up.

In our broad land with its many millions of workers, what percentage can be found following the sea for a livelihood? Is that percentage as great as in Scandinavia, or Great Britain, or in the Malay Archipelago, and do our people suffer by contrast in enterprise, resourcefulness or courage? Is not the merchant sailor one of the most helpless creatures to be found in a great city? In spite of the development of his character, does he either meet with much consideration at sea or find his training help him in the jostling crowd on shore?

There has been a time when it was actually proposed to keep our blue jackets in the service, like wing-clipped pigeons, through their very helplessness among their free fellows on shore. That time of reproach is past.

The modern blue jacket has not so much to do with the forces of nature in their elemental shape as he has with those of man in some of their highest and most complicated forms.

The higher the standard of our ratings among the kindred trades and professions on shore, the more certain the Navy will be to receive full consideration for its unquestioned merits and services. This is as true for the youngest apprentice as it is for the highest officer. The more certain too will parents be that the love of adventure that causes their boys to long for life at sea, will not result in years of wasted time. The more certain that a graduate apprentice, should he elect to remain on shore, will announce with pride rather than conceal his enlistment.

We are all aware of the comforts to be had with a docile ox-like crew of men, skilled in gun-lacquer and the mysteries of bright work, who will follow the routine steadfastly from all hands to pipe down with no thought of the future. Such a life, however, once sampled by the average young American, has no further attractions. We want our Navy to be American, but Americans as a people are intelligent and ambitious. Youth is commonly thoughtless and lives in the present, but it is doubted if there are not many of the boys on our training ships who do not fret at the delay and round-about path to actual service. There is not a trade in the land that is as wasteful of the time of its apprentices as we in the Navy; not a trade that goes so far afield to teach that which is right at hand.

The questions may be asked, are our apprentices instructed in those *simplicities* of our ships, injury to which send some of them so often to Navy Yards for repairs? Have they learned a better way to get a shaft into its bearing than by brute force? Do they know as much about a hydraulic jack as they do about a reef-tackle? Can they loosen a rusted bolt or put on its nut as well as they can make a Turk's Head? Have they learned what to do with rusted iron work? Can they read a drawing and follow the windings of an electric wire or drain pipe on a ship's plan?

In fact, can they help their officers take care of the ship, or is their very ignorance a source of danger to the equipment?

It is hard to eliminate sentiment from many of the most important questions arising in naval administration. The very cobbles along the road of the glorious past seem hallowed; used with judgment they might mend the way of the present, but sentiment insists on sacrifice and would often turn them into stumbling blocks. The realm of sentiment has no law; it is a land of regrets or enthusiasm, often as unfounded as unreasonable; still the man who never ventures into it is scarcely more than a machine. So it may be with regret; it should be at any rate with respect and veneration, that we turn from the worn problems of past conditions to those of the present.

Lieut. F. A. TRAUT, U. S. N.—Having previously had a few months' service at the Training Station, I came to the Monongahela a year and a half ago in doubt as to the relative merits of steamers and sailing ships for the training of apprentices, but rather inclined to condemn the latter. I have since become convinced, however, of the correctness of the views expressed in Capt. Chadwick's letter, and am glad of an opportunity to express myself in perfect accord with them.

We can train gunners on board a steamer, but if we want the apprentice to become the sort of man described by Capt. Chadwick there is no doubt in my mind that the sailing ship is better adapted to the purpose; nor is a short term of service on a sailing training ship anything but beneficial to the young officer as well.

Commander RICHARD WAINWRIGHT, U. S. N.—No one, who has been trained in sailing ships and has seen the results and assisted in the training of others in sailing ships, can deny the great advantage of such training in the formation of character. The American seaman is unsurpassed in adaptability, readiness in emergency and courage. Some of this is due to American character, as the above qualities are found to exist to a large extent in Americans under any decent training, and much is due to the training under sail.

No one who has grown up in the service when the motive power was mostly sails or hand power, and has witnessed the change to ships filled with machinery run by steam or electricity, can have failed to notice the want of mechanical ability in the best American seamen. A fine old quartermaster can ruin more telescopes and binoculars than a young apprentice. And the old-fashioned boatswain's mate or quartermaster will soon wear out an anchor engine or gun carriage. An old seaman is adaptable; he readily learns to run a machine, to do makeshift repairing; but he cannot run it economically, he cannot keep it in good repair. He is a fine jack-of-all-trades but not a master mechanic.

Few who have been trained with sails but have felt, when on a modern ship, the want of that concurrence of eye and hand called mechanical ability. The ordinary man can only acquire this by early training with tools, and about machinery. For our leading petty officers' and war-

rant officers' mechanical ability is a necessity. We look to our apprentice system to produce these men, and if the boys are not given early mechanical training, they will be crowded out in many cases by those of the landsmen training under the new system, who have had early mechanical training and have good American characters.

To produce the best results our apprentices, when on shore, must be trained in work-shops as well as in boats and on the drill ground. When at sea, acquiring the sea habit, so necessary to all classes of seamen, they must be in ships with modern machinery. They should be on ships with sail power, when possible, so that the polish of the sailor can be added in forming the character of the seaman.

I believe that with ships containing modern machinery, but also square-rigged, the apprentice can gain a valuable amount of sailorizing without detracting from his mechanical knowledge.

The modern seaman must have mechanical ability, and must acquire it by early training. The formation of his character can be greatly assisted by some training with spars and sails. The acquirement of knowledge and the formation of character must go together, hand in hand.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AN ADDRESS DELIVERED BEFORE THE NAVAL WAR COLLEGE, NEWPORT, R. I.*

By the HON. FRANK WARREN HACKETT, Asst. Secy. of the Navy.

Mr. President and Gentlemen of the War College:

A year ago the honor and pleasure were mine of coming here, as a messenger, bringing to you the hearty greetings of the Navy Department. To-day I am the bearer of like good cheer. I trust that, in order to be regarded as in some sense an old friend, I need not be driven to the expedient of reminding you that during the interval we have stepped from one century into another. At all events, I can assure you that the Secretary of the Navy and those associated with him note with increasing satisfaction all that your faithful labor is accomplishing at the War College.

The enterprise is now well beyond the stage of experiment. Its friends can have no fears for the future.

Seventeen years have passed since the first steps were taken to bring into being an institution that should provide for the "higher education" of officers of the Navy. During its early struggle for existence, the Naval War College met and dissipated that cloud of prejudices which is almost sure to envelope a project in its nature novel and experimental. The College has survived for the reason that faith has been kept with the promises of those who stood as its sponsors.

Already how excellent is the record. How clearly do we now see that the work done within these walls lifts the officer into a higher atmosphere, broadens his conceptions, and brings him

* At the annual opening, June 3, 1901.

distinctly nearer to that ideal standard of development which it has ever been the aspiration of the American Navy to attain.

The hour and the place are propitious for an expression of grateful acknowledgment to the accomplished officer and gentleman to whom belongs the honored title of the founder of the Naval War College. His long and busy career has been characterized at every step by an ardent desire to improve and elevate the profession which he so conspicuously adorns. In the exercise of a foresight of the highest order, this true type of an American sailor "turned to" (if I may borrow Jack's handy phase) and brought to bear upon those in authority such force of argument, and such well-directed energy, that Congress enacted the desired legislation and gave to the country a Naval War College, the first institution of the kind that the world has ever known.

It was the dawn of new era for the Navy.

To our good friend likewise is credit due that the institution was established where it should be—here in this historic harbor, a locality as affluent of advantage as it is of delights.

To the founder and constant helper of the War College, Rear Admiral Stephen Bleecker Luce, we extend a tribute of praise and sincere thanks. We persuade ourselves that Time likes to deal gently with him, so that the War College may still look for counsel to its Nestor during many a year to come.

What the college is, what its aims and purposes, and to what extent it may claim to have answered the hopes of those who from the first have believed in it, is to be taken, I assume, as fairly well known to all from cadet to admiral.

But it is not alone officers of the Navy who are watching with interest what you do here. That our ships, with their complement of officers and men, shall be kept always at the highest point of efficiency, ready upon the instant for war, is an object of concern to every citizen in the land.

We need not apprehend that the day shall come when an American, whether living on the coast or far inland, is indifferent to the status of his Navy. The people are alive to what you are doing here. They are well aware how much to them your work signifies of protection and security. They recognize the fact that it is for them that the War College opens its doors to annual classes; for them that the trained mind is still further disciplined,

made more alert, more resourceful, more familiar with the conditions and problems of actual war.

Since the development of our naval strength must rely upon the influences of an enlightened public opinion, we welcome the opportunity afforded by the annual opening of the course thus to remind the country at large of the results here attained.

The fact that the people, one and all, look upon their Navy with affection is to be attributed to something more than sentiment. To be sure, the sea and what is done upon it has in every age laid a spell upon the imagination of man. Allow for this subtile agency, there yet remains on all sides a conviction that American valor and prowess on the ocean are racial in origin; that it is to be counted on as a natural outcome of free institutions such as ours. The support ungrudgingly given by the country to its naval establishment furnishes to every officer and to every enlisted man an incentive to do his utmost to make the service worthy of public confidence and pride.

But how is an officer to do his utmost? To ask the question is to bring us to the consideration of what is submitted as the leading thought of this address, namely, that every officer of the Navy for the period of his active service should undergo a continuing process of education and training—not partial and fitful, but without remission.

Were you at this moment to confront me with the query, What ought an officer of the United States Navy to be? I should refer you to the text of a letter penned by as great a man as ever sailed under any flag, John Paul Jones. It bears date September 14, 1775, and is addressed to Mr. Hewes, of the Provisional Marine Committee of the Continental Congress. Read this remarkable letter, and you are advised of precisely those qualifications that a naval officer should possess. Its concise, direct terms are for all time. The description stands forth just as apt and as sufficient at this hour as it was when the author wrote it.

Let me add in passing, that readers of the recently published Life of John Paul Jones, by Mr. Buell, cannot too warmly thank that writer for his industry in bringing to light new material, and his skill in revealing to us the grand proportions of the man of whom he writes. Hitherto the world had known Paul Jones simply and exclusively as a sea fighter, the foremost of any age. We now, and most of us for the first time, see in him a statesman,

a diplomat of rare ability, and an accomplished man of the world. At last an adequate conception of our hero being thus presented to his countrymen, it would be an act of tardy justice to set up at Washington a memorial of John Paul Jones, where as yet none exists. Surely his statue deserves to occupy a place of honor at the Navy Department.

Much in the same way, were reasons to be demanded of me for maintaining the Naval War College, I should bid the questioner turn to the report of a board appointed by Secretary Chandler, May 3, 1884, to deal with the subject. This document, which is to be found in the Report of the Secretary of the Navy for 1885, is signed by Commodore S. B. Luce, Commander W. T. Sampson, and Lieutenant Commander C. F. Goodrich. The board did their work well. Their report sets forth the need of an institution such as this, and briefly outlines the scope of what it might hope to compass. The thought occurs that you may do worse than to put a copy of this instructive paper into the hands of each newcomer upon his reporting here for duty.

Here one finds a school where facilities are offered for that broader training which is demanded of those having in charge our modern ships of war. In days gone by, it used to be taken for granted that the attainment of high rank meant that the culminating point of skill and efficiency had been reached. They were indeed grand old sailors. Masters of seamanship, they displayed a tact in the handling of men that was the perfection of discipline. They enjoyed, all of them, an extensive acquaintance with foreign countries, and knew something of their own, along the seaboard. Their varied experience afloat and ashore (including a list of supposed hardships which they went through as youngsters) brightened their faculties, and created the type of the American naval officer, able, accomplished, always brave, such as no country in the world has surpassed. All honor to the memory of these gallant men.

But the day of these men is not our day. Alike in business, in professional life, in affairs of state, or in the art of war, a spirit of change has done its work, and much once thought indispensable has now been discarded as outgrown. Could Paul Jones, or Truxton, or Perry, or Decatur, come back to life and set foot upon one of our armored battleships, he would indeed be lost in wonder. Boundless would be his surprise at learning to what

extent the faculties and attainments of a commanding officer are taxed to answer the demands of his position. We are safe in saying of the naval officer of the present period that he must know more things, and know them accurately, too, than was ever demanded of him who trod the quarter deck half a century ago. New problems present themselves for solution, and some of the graver ones you deal with here at the War College.

As for education in general, I confess there is a strong temptation to discourse upon so attractive a topic. It has always been the fashion, and probably it always will be, to talk more or less about education. Now and then somebody of exemplary patience tries to fathom the subject, but we seldom hear that he meets with any great success.

As early as 1644, John Milton had composed his brief Tractate, condemning the methods of education then in vogue at the universities. But the production, with all the author's learning, offered scarcely a suggestion that was of practical use; though, happily, it has enriched literature by the noblest definition of education that can be conceived: "I call a complete and generous education that which fits a man to perform justly, skilfully, and magnanimously all the offices, both public and private, of peace and war."

John Locke, in his "Thoughts Concerning Education," gave much excellent advice that some of our colonial ancestors might well have thanked him for. About a century later, Pestalozzi advanced a plausible theory or two that brought him numerous followers; while Lancaster, long afterwards, undertook to tell our grandfathers how to manage their children. Of living writers, an essay of Herbert Spencer yields food for profitable reflection.

After the printing of so many books, and after so much discussion, one might imagine that the leading principles of education would be found substantially reduced to a science. Not at all. Parents and guardians are going ahead timidly now, much as they did in former times; while the average boy or girl remains as much of a puzzle as ever. For a while we try new methods, and then set them aside for others. They in turn have to give place to something else that allures with a promise. Still, out from all this partial success and failure there has come a residuum not without value. The schoolmaster manages some-

how to keep a little in advance of his pupil, apparently reconciled to the prospect that, provided he live long enough, he is sure to be looked upon as old-fashioned.

I venture to say that there may be someone present who, by an effort of memory, can recall a phrase once applied to young ladies at a boarding school, or, as is was customary to style it, "seminary." This phrase has dropped out of currency, but when it prevailed people used to say of the young woman that she was engaged in "finishing her education." For myself, I chiefly remember the expression because of a reply attributed to Doctor Wayland, an educator of eminence in his day. It is related, I believe, of the Doctor that at the close of certain graduation exercises a young lady came up to him and exclaimed: "Congratulate me, Doctor Wayland, for I have finished my education." "Have you indeed, my child?" said the good man, smiling, "you are more fortunate than I, for I am just beginning mine."

Now that we have a Naval War College, who would dream of saying of a captain, or of a rear-admiral, that he has "finished his education."

In prescribing a plan in the nature of a curriculum, the College has kept in view one cardinal proposition: Success in war lies in preparation. A simple truth, so simple indeed that you may call it commonplace, if you like. But a maxim may go unchallenged, and yet fail to impress itself upon the hearer at the moment he should be governed by it.

Being ready signifies something beyond the ability to get your ships, guns, and men at the place you want them, the very hour you want them. It means the presence on board of a master mind, that knows how to use this force to the highest advantage, the one man who can get out of it the greatest power wherewith to defeat and crush the enemy. A master mind does not find its way to supreme command haphazard. Training and hard thinking bring it about. To have such a captain close at hand—this is preparation; this is what it is to be ready.

Only let us be prepared, the world takes notice, and here we get one of the very few conditions upon which a government can rely for conserving peace.

The Navy, a body of highly trained officers, is, it can not too earnestly be declared, sincere in hoping that a state of peace may

long continue. It is doubtful if the service contains a single individual of the right spirit who does not stand ready to approve of any well-considered plan which promises to render the possibility of war more and more remote.

You who enter upon the course now opening do so animated by a desire for peace. True, you but obey a natural instinct when you seek to perfect yourselves in the lesson of being ready. It is the first duty you owe to your profession and to the country. Still, you would have it understood that the moving impulse is, that our naval strength be kept in such a state of instant efficiency that no power will hastily provoke war with the United States.

The American people cherish good will toward all other powers, and value a like good will in return. But we perfectly comprehend of what vital moment it is that every other power be impressed at all times with a wholesome dread of having the United States for an enemy. To this end, peace-loving as we are, we have announced it to be our settled policy to maintain a powerfully equipped Navy.

The people mean that in ships and guns the United States shall hold its rightful position. They never will tolerate that our seagoing force fall into an inferior rank among the navies of the world. The largest measure of safety, they firmly believe, rests with that country whose naval authorities can put the better brain upon the bridge.

Holding this high purpose in view, you assemble here that you may engage in the task of educating yourselves; for this is a college without professor or text-book. All are students. You are to learn something of naval tactics and naval strategy. You will listen to lectures upon naval history, upon international law, and like topics; some of you will prepare and read papers dealing with naval campaigns; you will point out and discuss the causes of success or failure attending naval operations of our own and of other powers.

But the unique feature of the course is what is known as "the war game." Here one finds out empirically into what sort of a situation he is likely to be precipitated in the event that war shall suddenly come upon us. It sets a man to thinking what he had better do about it. When an officer goes away at the end of the course he carries with him a new stock of ideas. Later, upon

taking command of a ship, there would seem to be no reason why he may not improve the opportunity to impart some of these ideas to junior officers. In this way the influence of the Naval War College may be exerted in numerous directions.

The sinking of Cervera's fleet was not the execution of a plan suddenly inspired. On the contrary, that memorable July forenoon saw wrought out that which, in its beginning at least, was rehearsed, so to speak, in these very halls. An incident that occurred not long after the close of the war serves to illustrate my meaning. Rear Admiral Sampson happening to be here, saw suspended on the wall a large chart of the Cuban coast. It bore certain marks that denoted the movements of war vessels. The Admiral took it to be a chart that had recently been prepared for the purpose of illustrating certain features of the Spanish war. It turned out, as a matter of fact, that he was looking at a working model that had been put to use two years before the war in the study of an imaginary campaign against Spain.

So, too, the contingency of scouting in the West Indian waters during supposed hostilities with Spain had not been neglected. For the purpose two rooms were occupied. An officer in each room represented a contending force. Each started with a like knowledge of the number, character, and the assumed disposition of the ships of the other. Each did the best he could to fix the whereabouts of his opponent. On a signal work was stopped and the officers compared results. It is told of one accomplished commander whose ship did invaluable service as a scout on the Cuban coast, that while thus engaged he found the work strangely familiar, and said of it: "Why, it seems as though I am sure later on to hear Taylor's bell."

Another illustration of the benefits of the instruction here will, I think, interest you. You will recall the fact that during the Spanish war Rear Admiral Remey served on board the *Lancaster*, a station ship at Key West. The Admiral was the center of communication between the Navy Department and our fleet in the West Indies. How well he performed that duty you need not be told. An officer of Admiral Remey's staff is quoted as having said of the work in the Admiral's office, that it "was exactly like the work during one of the War College war games; and that no study could have better fitted one for the real thing."

Were nothing else to be gained from a season spent at the

College, the participant in the game of war grows accustomed to approach a problem in maneuvers or strategy with some degree of confidence. He gains here, as he could nowhere else gain, a familiarity with many of the conditions of actual conflict. In other words, an emergency does not overwhelm him with surprise. More than this, the experience affords him an insight into what nine times out of ten the enemy is likely to do.

We may go a step farther and say that it is among the possibilities that some daring mind, kindled here with ambition to surpass his fellows, may one day conceive of an original idea in naval tactics, the realization of which will give to his country a tremendous advantage.

The United States in enlarging its borders and taking to itself foreign possessions has indeed assumed a grave responsibility. To the Navy is largely due their acquisition. Upon the people of these distant islands we are conferring the blessings of good government. For their protection and welfare we shall continue to look, in a large measure, to the Navy. Nor shall we be disappointed.

Never before in time of peace have there been held out to officers of the United States Navy opportunities so inviting to do good and lasting service to their country.

Let the standard of the Naval War College be maintained. Then, when war comes, and the people turn to their Navy, it will be with perfect confidence that its deeds shall deserve well of the Republic.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

EXPLANATION OF COURSE AT THE NAVAL WAR COLLEGE.*

JUNE 4, 1901.

By CAPT. F. E. CHADWICK, U. S. N., President of War College.

It is considered not out of place to say some words to those who have not been here before regarding the object of the College and its work, as there is not even among all of us in the service a clear understanding regarding these. It is necessary, in making an explanation of its purposes, to touch upon the study of the art of war in general, and say something of what has been done by other nations looking to the education of their officers and their preparation for war.

I think we may grant that war is the largest and most difficult business in which any one can engage. It is always the disruption to some degree, and sometimes in their entirety, of all our social forces and conditions, and a clearing of the way for their reconstruction. It is the letting loose of the social volcano, and the guidance of these gigantic forces is principally the province of the Admiral and the General. If study and experience are necessary in banking, in administering a governmental department, or a great system of railways, it is naturally the part of wisdom to suppose that they may be good, in fact, necessary, in this business of war, which is so much greater than any which can fall to our civilian brother. It would seem that the statement should be axiomatic, but the great mass of military men are unquestionably loth to accept it in practice. However willing they

* Opening address delivered by the President of War College, June 4, 1901.

may be, if pinned down to the point to admit the truth of what is just said, their habit, at least in general, is to allow it no weight whatever. We usually go on in the routine of the service, doing what comes to our hands to do, hoping that when the time comes to beat an enemy, we shall be ready and able to do so by the gift of God which comes to us by steady advancement through the grades of the service.

But all experience is against this; there have been certain great masters in our profession, some half-dozen of the foremost rank; and though we do not know overmuch of the views and habits of study of most, we know very thoroughly those of Napoleon, the greatest of them all; and no one can be more emphatic in regard to the value of the study of the work of those who had preceded him; and there is no question that he himself was a most diligent student, genius as he was. If such a man thinks study necessary, how much more needful is it for those who are not geniuses, and who must, therefore, depend upon the principles which govern our business. For there are such principles. War is not a haphazard game any more than the great game of commerce. It requires the study of conditions, means, appliances, and, above all, that study of lines and bases of operation which is known as strategy. The first complete and methodic dealing with this great subject was the epoch-making work of Jomini, which has become a classic and which, though it has had many successors, still stands in the front rank.

When we look over the field covered by the art of war, as tabulated by Jomini, I think there is no one who will say that there is no place or need in our profession for a college for the particular study of war as an art. He divides this into six distinct parts:—

1. Statesmanship in its relation to war.
2. Strategy, or the art of properly directing masses upon the theatre of war, either for defence or invasion.
3. Grand Tactics.
4. Logistics, or the art of moving armies.
5. Engineering—the attack and defence of fortifications.
6. Minor Tactics.

Though Jomini only touches upon maritime affairs "to be taken," as he says, "in connection with maxims of descents," his treatment of his main subject applies in principle to fleets as well

as armies. The fleet is simply an army moving with much greater rapidity than land forces. Its supply and maintenance involve the same considerations, and it is extraordinary that so great and original a mind as that of Jomini should not have grasped the more essential facts connected with command of the sea. It is the great pride of this College that it was the instrument of bringing before the world the views now accepted by all, of the overpowering influence of the army of the sea as contrasted with that of the army of the land. It was the great mind of Mahan which accomplished this revolution, giving sea power its logical supremacy in the minds of men which we can now all see it has always had in actuality. Had this College never had any further outcome; had it stopped with this result alone, its establishment would have been justified many times over. Mahan's work in giving naval power its just due has had a revolutionizing effect in international policies. It is not too much to say that no event in the latter half of the XIXth century did more to direct the world of statesmanship into new lines of thought than these great works of an officer of our Navy, and I do not think the weight which this College had in directing his own thought, and in the production of his great works which were first produced as lectures before the College, and as the natural outcome of his duties here, should be lost sight of.

Administrative reforms with us work slowly. The Naval Academy had to be forced upon the service. I myself was on duty there with an officer (and it was only twenty-six years ago) who, when he took up the duty of superintendent, was an utter disbeliever in its utility. I had this from his own lips, when he assured me, however, that he had now seen enough of it to change his mind. We have been more than a hundred years in bringing about the establishment in the Navy Department of a Bureau of Personnel, thus gathering into one section of the Department nearly, but not quite as yet, all things military, and we have been more than a hundred years in establishing a General Staff, which I hope is now accomplished in the triune organization of the General Board, the War College and the Intelligence Office. For the great province of this College is not so much in the work of the summer's course as its studies in General Staff work, with which, of course, the summer's work on the General Problem is in line.

Going back to Jomini's tabulation of the art of war into six parts, the first of these, it will be noted, is the great field of statesmanship, under which he brings, among other matters, military policy and military statistics and geography. Under the first-mentioned he embraces all the combinations of any projected war, except those relating to diplomacy and strategy, including the passions of the nation to be fought, its military system, its immediate means and reserves, financial resources, character of government, the characters and military abilities of the commanders of their armies, the influence of cabinet council or councils of war upon their operations, the system of war in favor with their staff, the military geography and statistics of the State to be invaded.

I would beg to recall how much we would have given in our own little war with Spain for thorough and accurate information regarding that which I have just quoted. There is no need to dwell upon the importance of such knowledge as an element of success No man can deal with war without feeling that, after ships and men, the one all-important thing is information, and no expense, no difficulty and, above all, no preliminary study should be spared to provide this.

While information is mainly the field of the Office of Intelligence, the remainder of Jomini's tabulation is largely the province of this College, covering a vast field of study, to much of which there is definite solution in any particular case.

An important field of work for the College is always that of battle tactics, to which we cannot give too much thought and study. The development of the musket and of field artillery; the development of heavy guns and of the torpedo have caused both armies and navies to go about their ends in a very different manner from that of fifty and one hundred years ago. The principles remain the same but the methods must differ, and the land and sea forces of the whole world are now studying this vital question. That it may take some time to develop these to perfection is not improbable, but we may hope that it will not take the centuries that were needed for the development of tactics under sail.

It may not be generally known that for a hundred years previous to the appearance of Clerk's work on Tactics in 1779, all actions between the French and the English were of a very indecisive character. Rodney made a first application of Clerk's prin-

ciples in his action with de Grasse. The final and successful tactics under sail were thus worked out in the solitude of a student's study, though there were hundreds of officers at sea to develop views, and scores of battleships with which to test them. This is an extraordinary fact and one which should not be lost sight of when the value of a place of study such as this is discussed; and I thus believe it is here where the question of tactics will be finally solved, because it will probably be here that some active-minded genius will have the time and opportunity for thought and study which one so rarely gets at sea. England, at the period of the publication of Clerk's tactics, had few officers who made an independent study of either tactics or strategy, and to this fact is clearly due a failure which made certain the loss to her of the American Colonies. Had Rodney not gone home on leave just at the time he did, it is beyond question that, with the opinion and views held by him, de Grasse would have failed to support Washington and Rochembeau; Cornwallis would have been relieved, the Yorktown expedition would have failed, and the consequences would probably have been fatal to the American cause. Rodney left orders covering the eventualities, but they were not obeyed. Admiral Graves, with faint conception of the enormous importance of his influence upon the situation, failed after his action with de Grasse to enter the Chesapeake, which, if he had done, would have prevented de Grasse from re-entering and would have prevented the reception by the allied forces of the siege train sent with the squadron of Barras from Newport. The result was one of the great turning points in the history of the world. This incident is mentioned merely as one of many to illustrate the fact that we cannot ignore preliminary study of strategic questions; that there must be a general study of these in order that we should not be at the mercy of chance as to whether the commander-in-chief has thought or not.

If we do not have this general study the chances are that he will not have thought, and even if he be a man such as Rodney, it is far better that he should have the aid of many minds instead of standing alone and unassisted. The united and long-continued study and thought of a large group of men are of more value than the off-hand thought of any one man of like mental calibre, and it is on this principle we have, in some countries at least, a general staff and places of study for such a staff akin in some degree to this.

I will supplement what I have just been saying here regarding the working out of the successful tactics of the last century in a student's study ashore, by quoting some of the remarks of the French Minister of Marine in introducing the bill in 1899, "establishing a school for advanced military and naval study." It was not the first effort of the French in this direction. Though the first report on the subject was submitted by the minister in 1882, the decree establishing the school was not issued until 1895, modified in 1896, again in 1898, and the new bill brought forward in 1899. M. Lockroy, in his explanation, appended the report of the Committee on Naval Affairs, in which occurs the following, which is apt to what has gone before. I quote:

"We beg leave to disagree at this point in order to refute, from now on, a theory which is in vogue and which seems to us dangerous—the theory which sets it forth as a principle that the fleet is the only proper school of tactics for the navy. The fleet is not a school, but a fighting force of the first rank, where each person is at his battle station, his mind absorbed by the heavy weight of his personal responsibility and the multifarious details of the duty with which he is charged. The fleet is no more a school than the sixth corps in the Vosges or the second division of cavalry at Luneville. Instruction is carried on there, to be sure, and professional knowledge increased, because at each step in the ladder of rank and command, the senior is the natural instructor of those who are under his immediate command; but this is done only according to strictly, one might say, officially defined lines, and beyond which it would be hazardous to authorize experiments, however instructive these might otherwise be. On each ship the divisional officer is at his guns, the torpedo officer at his torpedoes, and as we have stated in our general survey of the subject, it is attention to these details which, except when he is on watch, make up the officer's duty. It will be urged, no doubt, that officers should be informed of the scheme and purpose of each manœuvre, and that on the completion of the same these officers should be assembled by the admiral for the purpose of a general *critique*. Undoubtedly that is desirable; but how difficult to accomplish in practice! And, furthermore, would it not show a poor knowledge of human nature to fail to take into account the lack of interest of all persons in that which does not immediately concern themselves. At the most the

fleet is a school where the commander-in-chief and his personal staff may gain instruction."

I quote this to show that others are beginning to recognize what we expressed in the establishment of the War College.

The Germans have been the leaders in staff organizations, traces of which appear as early as 1655, and there were a very considerable body of officers doing staff duty as early as 1670. But the General Staff of to-day had its real start only in the beginning of the XIXth century, and its present basis dates only from 1821, when it was taken from under the Ministry of War and subordinated only to the commander-in-chief. Its numbers have gradually increased until, in 1898, were attached to it 229 officers, of whom twelve were General Officers. Within the General Staff is the Great General Staff of 123 officers, whose duty is wholly in the Great Staff building at Berlin, where they are entrusted, under the immediate direction of the Chief of Staff of the Army, with the preparation of plans of large military operations, with the collection of knowledge of and comparison of European military administrations and the study of the theatre of war; and, in addition, with the preparation of maps, the promotion of military history and, finally, with the training of young officers.

93 officers of the General Staff are with the troops to execute the measures inaugurated by the Great General Staff while obeying at the same time other (minor) orders of the general commanding the units of troops to which they are attached.

Appointments to the General Staff are through the War Academy, where 400 officers are maintained by the admission through competitive examination of from 100 to 150 yearly. These officers must have had at least three years service with the troops. They remain three years at the War Academy, being assigned three months in each summer while there to regimental duty, with another arm of the service than their own. The fourth summer is taken up by a General Staff journey. On graduation all return to their regiments until the following spring, when about twenty of the total are selected to take a probationary turn with the General Staff of from one to three years, at the end of which some are attached to the General Staff as full-fledged members, those unsuitable being returned to their regiments. A temporary return to regimental duty is, however, compulsory from time to time for all the General Staff officers.

The extraordinary care and time expended in the selection of these officers show the immense value set upon staff work by the German authorities. That it has had full fruition we all now know in the results of the campaigns of 1866 and 1870. The downfall of two great empires was the direct outcome of the thorough staff work of which at the time Moltke was, and had been from 1857, the head. In the face of the mighty results of the system it is vain to decry such studies. The other great military powers of Europe had, of course, some such organization, but none had the complete and flexible system of Germany. France began fair, but in 1832 the system of return of staff officers to the line was given up, and the staff naturally stiffened into the unwholesome and unprogressive routine inseparable from the continued occupancy of directive posts. There can be no surer road to inefficiency, not that it is down hill, but that it ceases to ascend, and we had the natural results when the two systems were pitted against each other in 1870. It will be seen that the Great General Staff covers the field which is now covered by our General Board, the Intelligence Office and the War College. These three organizations are thus closely interlaced, and as time goes on they will become more and more so. The partial separation is not at all a disadvantageous one, and, in fact, has many advantages. The Intelligence Office is our collector of information, very much of which does not apply to military study; the War College is the collator of such information on military subjects, whatever its origin, which has a bearing on questions of war. It is in nowise a teaching establishment in the ordinary sense of the term. It is a place for the study and discussion of military problems; for the study of war in all its phases, historical, strategical, tactical; of the events which lead up to war; of international situations, and of the probabilities or possibilities which might arise therefrom. Besides carrying on the study of such questions as continuously as its limited staff will allow, it prepares and lays before the General Board such studies as may be particularly called for. The aim, however, is to prepare, in connection with the General Board, studies for all eventualities, so that the Department may be able to furnish a commander-in-chief in war with complete studies of the theatre of war; with thought made to hand, so to speak, and enable him to act unhampered by the necessity of forming a judgment off-

hand regarding a great variety of questions on which hasty judgment cannot be safely made.

I should like to quote here some words of Admiral Taylor's taken from his "Memorandum on a General Staff for the Navy," which appeared in the PROCEEDINGS OF THE INSTITUTE of September last. After speaking of the real functions of the General Staff of an army or navy, he says:

"The second element, though rarely recognized in a formal manner, is by far the more important of the two. It is the mental training of officers engaged in this plan-making, and their consequent readiness to confront warlike situations in general. It does not equal the school of actual war, but it is only second to it—and there is no third method. This trained readiness of officers' minds, in the Franco-Prussian War of 1870, constituted the essential value of the diligent staff work done by the Germans during fifty years of peace. What the world at large saw were the plans of work perfected in all minutiæ, railroad cars numbered for special work, arriving near battlefields on schedule time, bringing guns or men, pontoons or hospital beds. This it was which, being so admitted, gave to the staff its reputation among non-professional people, and it was, in fact, a most valuable aid in the battle and campaign; but far greater, as a factor of efficiency, was the state of mind of German officers—from generals down to majors—that familiarity with war situations, acquired in the staff work of peace, which enabled them to confront all emergencies of the campaign with ready energy and composure of mind."

There are lectures during the summer course on various subjects which, though they may not in all cases be closely allied to the warlike side of our studies, are in the broad field of thought which staff studies must cover. Among these, and occupying a prominent place, are the lectures and studies in international law. This part of the course in this year will be dealt with, excepting in one instance of a short course of three lectures, by a more extended and thorough study of cases than has been attempted heretofore, in which I think all of us cannot help being interested.

From what has been said it will be seen that the attendance of officers during the summer is an adjunct only of the College work. We must naturally look forward to development upon the lines

which the long and successful experience of such a military expert among nations as is Germany has laid down for all of us. I may say that the Department has taken the first steps in obliging commanders-in-chief to send in lists of younger officers whom they consider particularly fitted for staff work. If we follow the natural trend of such training, these officers will be passed through terms of services at the War College and the Office of Naval Intelligence, so that in time the service will have a large body of men trained for such duties.

Events have forced upon us the necessity of a large navy. We cannot as a country lead the happy-go-lucky existence of the last century, when the world went its way thoughtless and careless of the United States. In all that period we emerged but three times from our attitude of exclusiveness in regard to international questions: once in 1823 in the Monroe Declaration; a second time in 1866 on the same principles in regard to France, and a third time in 1897 in regard to arbitration between Great Britain and Venezuela. Since then we have developed a great fleet, have stepped into a great international position, have extended through one hundred and eighty degrees of longitude or just half round the world, have become the greatest coal raiser and coal user, and, consequently, the greatest manufacturer. Such a position demands the best thought and the best judgment of the nation's directive forces, and it behooves us of the Navy to do our part in upholding the national credit by preparing, according to the best of our lights, for any part we may be called upon to play.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE NAVAL CAMPAIGN OF LISSA; ITS HISTORY, STRATEGY AND TACTICS.

By W. Laird Clowes, Member of the United States Naval Institute.

The naval campaign of Lissa lasted for little more than a month; yet there is probably no naval campaign—certainly no modern one—of even ten times the length, which presents so many points of interest, so much suggestion, and so great variety to the student. Ironclads were in their infancy; for the Warrior had been less than six years afloat, and not five years had elapsed since the building of the Monitor. Both Italy and Austria, nevertheless, had already acquired a respectable squadron of armored vessels, and although many obsolete craft were also employed, the back-bone of the fighting force on each side was composed of ships which were then absolutely modern, in the sense that not one of them was five years old. Several of them, moreover, were good enough to have deserved a place in the fighting line of any first-class naval power of the time, and had been designed by the most reputable constructors, and built in famous French and British yards.

The brief campaign included not only a pitched fleet action, but also a certain amount of preliminary scouting, and a series of attacks upon forts, with an attempt at landing. Apart from all this, Lissa has the distinction of being the first battle between armored fleets in the open sea.

The commanders-in-chief on each side were notable personalities. Wilhelm von Tegetthoff, the son of an Austrian staff-officer, was born at Marburg, Styria, on December 23, 1827, and was educated at the Marburg Gymnasium and, from 1840

to 1845, at the College for Naval Cadets at Venice. In 1845, being then in his eighteenth year, he entered the Austrian Navy as naval cadet in the brig Montecuccoli, and later joined the corvette Adria. Obtaining a commission in 1848, he was appointed successively to several ships which served in 1848-49 in the blockade of Venice. In 1854, having continued in active service and attained lieutenant's rank, he was given command of the schooner Elisabeth, which cruised in the Levant, and, in 1855, of the steamer Taurus, which did police duty at the mouth of the Danube. In 1857, he accompanied Dr. Heuglin, the ornithologist, to the coasts of the Red Sea and the Gulf of Aden, and, in Somaliland, was taken prisoner and detained until a ransom was paid for him. While at Aden, he received news of his promotion to be Corvetten-Capitän, and, on his return in 1858, he was given command of the screw corvette Erzherzog Friedrich, in which he visited the coast of Morocco to enquire concerning some shipwrecked Austrian subjects. During the Franco-Italian War with Austria, he was assigned to the defense of the Venetian lagoons. He next became adjutant to the commanding admiral, the Archduke Ferdinand Max, whom he accompanied in the Elisabeth to Brazil. In April, 1860, he was made Fregatten-Capitän, or commander, and appointed to the screw frigate Radetzky in the Levant. In 1861 he was given the screw frigate Novara, and again sent to the Levant, this time as senior officer. In 1863 he turned over to the Schwarzenberg, and visited the Suez Canal works, but was recalled and ordered to the North Sea, where he fought the battle of Heligoland. He was subsequently made a rear-admiral. After the War of the Duchies he worked at Vienna at the reorganization of the navy, and also held command in the Mediterranean. Just before the war of 1866 he was about to take command of an expedition to Eastern Asia. After that war he travelled extensively; brought home in the Novara the body of the Emperor Maximilian, and served from 1868 as Chief of the Naval Section of the Austrian War Office. He died on April 7, 1871.

It is worthy of remark that von Tegetthoff won his great success when he was less than nine and thirty. Nelson was more than forty-seven at Trafalgar; Farragut was more than sixty-three at Mobile Bay; Duncan was sixty-six at Camperdown; and Howe was sixty-eight on the " Glorious First of June."

Von Tegetthoff's opponent was sixty when he was defeated at Lissa. Count Carlo Pellion di Persano was born at Vercelli, in Piedmont, in 1806, entered the Sardinian Navy in 1824, and attained the rank of captain in 1841. In command of the Daino, in the war of 1848-49, he distinguished himself. In 1851, in the Governolo, he took to England the Piedmontese exhibits for the exhibition of that year. During the operations of 1859, he commanded the Carlo Alberto, and was made a rear-admiral. He cooperated with Garibaldi on the coast of Sicily, directed the naval attack on Ancona, and received the sword of Lamoricière. For these services he was made a vice-admiral. In 1862 he was Minister of Marine, and, on retiring from politics, became an admiral. He had previously married an Englishwoman. After Lissa he was tried, and, on January 29, 1867, acquitted, on charges of cowardice and treason; but on April 15 following he was found guilty of negligence and incapacity, and was deprived of his rank, dismissed the service, and condemned to pay the costs of the trial. He died on July 28, 1883.

The authorities to which I am chiefly indebted for the following account of the campaign are:

a. The official despatches and ships' logs, Austrian and Italian.

b. "Der Kampf auf dem Adriatischen Meere im Jahre, 1866," published in 1869 by the Austrian General Staff, when von Tegetthoff was serving on it. For a copy of this I am beholden to the courtesy of the Marine Section of the Imperial and Royal Austrian-Hungarian War Ministry and to the personal kindness of Vice-Admiral Alexander Eberan von Eberhorst.

c. "L'Ammiraglio C. di Persano nella Campagna Navale dell' anno, 1866," published at Turin in 1873.

d. "Rendiconti delle Udienze Publiche dell Alta Corte di Guistizia nel Dibattimenti della Causa contra l'Ammiraglio Senatore Conte Carlo Pellion di Persano, precedentti dalla relazione della Commissione d'Instruttoria," published at Florence in 1867.

e. "Ancona e Lissa," the work of an Italian naval officer, who published it anonymously at Ancona in 1866.

f. "Relazione prima della Commissione d'Inchiesta sullo stato del materiale della Regia Marina," published at Florence and Genoa in 1867.

g. "Geschichte des Feldzuges, 1866, in Italien," by Capt. A. Hold; published at Vienna in 1867.

h. "Lissa." (*Revue des Deux Mondes*, November 1, 1866.) Attributed to the Prince de Joinville, who, however, denied the authorship.

i. A paper by Vice-Admiral Touchard in the *Revue Maritime et Coloniale* of 1866.

j. "Lessons from Lissa." A lecture delivered by the late Vice-Admiral Coomb on April 29, 1867.

k. An article in *Archiv für Seewesen* for 1866. Another in *Rivista Marittima* for January, 1869.

l. "Tegetthoff." By Prof. J. K. Laughton, R. N., in *Fraser's Magazine*, June, 1878.

m. Personal communications from officers, Austrian and Italian, who were present at the battle of Lissa. As several of these are of a confidential nature, I am precluded from giving the names of my informants.

I. Preliminary Movements of the Austrians.

1. Previous to the declaration of war on June 20, 1866, by Italy against Austria, hostilities by sea as well as by land had become almost inevitable, and Rear-Admiral Wilhelm von Tegetthoff, who had been placed in command of the imperial fleet, had made up his mind to neglect no opportunity for assuming the offensive. He lay in the roadstead of Fasana, Pola, with his force at anchor in four lines as follows:

FIRST LINE.	SECOND LINE.
Prinz Eugen,	Schwarzenberg,
Drache,	Donau,
Kaiser Max,	Adria,
Salamander,	Radetzky,
Don Juan,	Erzherzog Friedrich.
Erzherzog Ferdinand Max,	
THIRD LINE.	**FOURTH LINE.**
Hum,	Elisabeth,
Dalmat,	Greif,
Wall,	Stadium,
Velebich,	Andreas Hofer,
Reka,	Triest.
Streiter,	
Narenta,	

2. The armored frigate Habsburg, the screw line-of-battle ship Kaiser, the screw frigate Novara, the screw gunboat Seehund, the screw schooner Kerka, and the paddle-vessels Santa Lucia and Vulcan, had not then joined the flag. The Santa Lucia and Triest were, after the declaration of war, detailed to serve as despatch-boats for the maintenance of communication between Pola and the fleet, and took no other part in the operations of the war. Particulars of the remaining Austrian vessels, as well as of all the Italian ships that were actively engaged, will be found in the tables to be given hereafter.

3. On June 20, Rear-Admiral Tegetthoff ordered the Stadium to reconnoitre the Italian coast from Ancona to Bari; but she returned on the 23rd, unable to report that she had observed any concentration of the Italian naval forces. This induced the rear-admiral to quit Fasana, and to make observations for himself. On the 24th he shifted his flag from the Schwarzenberg to the ironclad Erzherzog Ferdinand Max, and telegraphed to the Archduke Albrecht, the supreme commander-in-chief, requesting to know whether the fleet might assume the offensive, or, at least, reconnoitre the Italian coast in force. It happened that the 24th was the day of Custozza, and that the Archduke, the victor in that action, was too much occupied to reply until the 26th. He then returned an answer to the effect that nothing stood in the way of the fleet's freedom of action within certain limits, but that operations must not be extended beyond Lissa, and that the mouth of the Po and the coast of Venice must be taken care of. In the interval the rear-admiral consulted with his captains and made provisional arrangements for operations against Ancona. The delay was not important, but it might have been so. In such a case, the command ought to be vested in the man on the spot. Austria possessed no second fleet with which it was necessary that von Tegetthoff should coordinate his movements.

4. Upon the receipt of the Archduke's reply, von Tegetthoff, who waited until the evening, sailed with the Erzherzog Ferdinand Max, Prinz Eugen, Kaiser Max, Don Juan, Drache, Salamander, Schwarzenberg, Hum, Streiter, Reka, Velebich, Elisabeth and Stadium, and appeared before Ancona at daybreak on the 27th. At about 3 A. M., the Elisabeth, which was scouting ahead of the fleet, sighted the Italian despatch-vessel Esploratore,

which was cruising before the port, opened fire on her, and, assisted by the Velebich and Reka, chased her in shore. All the other ships cleared for action, and, from 5.30 to 7.30 A. M., remained off the town at a distance of about two and a half miles. In the roadstead could be seen the Italian fleet, the greater part of which had left the Gulf of Taranto on the 22d, and reached Ancona on the 25th. Eleven ironclads, four frigates, and two despatch-vessels could be counted; and smoke from other funnels could be observed rising above the quay of the inner harbor. The Italians were quite unprepared for this exhibition of boldness on the part of the Austrians. Persano made a signal which was not generally understood by his captains, and which, had it been understood, could not have been generally obeyed, several ships not being ready.

5. Several of the Italian vessels got up steam, and two of the largest ironclads were put under way; but no craft ventured out, although the Austrians remained in the vicinity long enough to have enabled the Italians to challenge an action, had they been ready. The moral effect of this insult to a superior force by an inferior one was great on both sides.

6. The project of attacking an enemy of superior force, at anchor and protected by shore batteries, and possibly by mine-fields as well, did not recommend itself to the Austrian rear-admiral, who, therefore, at about 8 A. M., drew off to the westward, putting his wooden ships in the van. Before sunset he re-anchored off Fasana, where he found the Habsburg, which had arrived during his absence. Could Tegetthoff have induced the Italians to leave port, he would have given them battle, even on the 27th, when he was without the Habsburg, one of his two best ironclads; but he was too good a strategist to be willing to enter upon any operation which might weaken his own force without exposing the enemy's fleet in a corresponding degree. The Italian fleet was his first object throughout.

7. From that time, as there were rumors of an Italian descent upon Venice, all ships in port kept steam in half their boilers in readiness for immediate movement. On the 28th, towards sundown, Fort Brioni signaled that an ironclad, flying a tri-colored flag, was in sight fifteen miles off. The Kaiser Max and Don Juan were ordered to proceed on reconnaissance, and they soon recognized the stranger as the British central-battery

armored sloop Enterprise, Commander Charles John Rowley, which was on her way from Ancona to Triest. On the 29th the Prinz Eugen proceeded to Malamocco (Venice), and, on the 30th, returned convoying a collier. On the same day a telegram, despatched by Field-Marshal-Lieutenant Baron Philipović, Statthalter of Dalmatia, informed von Tegetthoff that the Italian fleet was still at anchor in the roadstead of Ancona; that its force was stronger by four frigates than it had been observed to be upon the 27th; that it would probably be soon complete, and that, confident in its superiority, it would presently take offensive action.

8. The Austrians, after their return from before Ancona, made their final preparations for the struggle. All gear and stores that would be of no immediate value during an engagement were removed from the ships; the fleet pay-chest was divided among several vessels, and a new signal-book, which was to come into use on July 4, was perfected. The adoption of a new signal-book at the beginning of hostilities has disadvantages as well as advantages.

9. On July 4, von Tegetthoff was reinforced by the Novara, which, by dint of extraordinary hard work, had been refitted in an incredibly short time in Tonello's yard at Triest, and subsequently armed and manned at Pola. She had been seriously damaged by fire at Pola on May 3.

10. On July 6 the rear-admiral took his fleet to sea for exercise at steam tactics, and carried it within sight of Monte d'Ancona, but brought it back to Fasana after dark and re-anchored it. This brief cruise seems to have satisfied von Tegetthoff either that the Italians were still far from ready, and so could not leave port, or that they were inclined to neglect his fleet, and embark upon ulterior operations without having first reckoned with him.

11. On the 9th the rear-admiral summoned all his captains on board the flagship, and learnt their views as to the seaworthiness and general behavior of their vessels; and, on that and the two following days, fires were drawn, and the machinery and boilers of all the vessels were thoroughly cleaned. This, though a measure of wise precaution, might have been risky at such a moment, if the Italians had been ready and venturesome; but by that time von Tegetthoff had formed conclusions about the character of the Italian chief.

12. The Italians, in a manner which then appeared inexplicable, still delayed the commencement of their operations; and it was not until July 10th, on which day the arrival of the paddle-steamer Vulcan brought up the Austrian fleet to its intended strength, that news reached Fasana that about twenty hostile vessels were in sight twenty or twenty-five miles off Lissa, and that an Italian squadron of sixteen sail was off Isola Grossa. Von Tegetthoff could not then put to sea in force, owing to the orders relative to his machinery and boilers; nor did he want to. He desired, rather, to see the Italians commit themselves to some useless, inconclusive, and possibly damaging venture, and so lay themselves open to his onslaught under favorable conditions.

13. These movements led to no immediate results; and in the course of the 12th and 13th of July the Government of Dalmatia was enabled, by means of the Fiume, Venezia and Egitto, and of the Santa Lucia and Vulcan, which were lent from the fleet, to obey orders from the Minister of War to send to Triest four battalions from Sebenico, Lissa, Castelnuovo and Cattaro. The enemy did not attempt to interfere. Indeed, between the 14th and the 17th the Curtatone was allowed, without hindrance, to carry part of the Hohenlohe Infantry Regiment from Cattaro to Zara, and then to return to her station at Cattaro. Nothing could show more clearly the ineptitude of the Italians and the inefficiency of their scouting arrangements. They had cruisers enough, if not to stop all such movements, at least to report them. It seems that they were not observed at all.

14. On the 14th the British sloop Enterprise again passed and was sighted; and on the 15th, the Drache, which was cruising in the offing, observed the French armor-clad Provence, bound for Venice. It seemed as if the prospect of an action at sea was becoming remote. The mediation of France, on the basis of the transfer of Venice to Italy, had begun; and the presence of a French battleship which, according to an official intimation received in the fleet on the 11th, might be regarded as the precursor of a French squadron, seemed to indicate that the negotiations were moving to a conclusion.

15. Rear-Admiral von Tegetthoff was very anxious concerning the influence which the rumors of the surrender of Venice, and of the retirement of the Austrian Southern Army, might

have upon his men, eight hundred of whom came from Venice, and he begged the Minister of War, in case of the actual surrender of that city, to order the Venetian seamen to be sent ashore; but the answer that came back was: "Venice not yet given up; task of the squadron unchanged;" and this despatch, published as a fleet order, not only tranquillized the command, but also reassured those more energetic spirits who had begun to fear lest the navy might have no part in the campaign. Moreover, at about the same time there came from the southward news that the Italians seemed disposed to abandon their inactivity and to make a movement of some kind.

16. At last, on July 17, there reached the fleet at Fasana the following telegram from Lissa: "A man-of-war, under British colors, came in sight from the N. W., reconnoitred the island, and has drawn off to the S. E.;" and on the 18th, at 11 A. M., there arrived from the same place two despatches dated respectively 8.30 and 9.20. The first ran: "Nine ships-of-war, without colors, are about twenty miles off, and are approaching the island from the N. W.;" the second: "Ten war-steamers, fifteen miles off and under French colors, are approaching from the direction already signalled."

17. Rear-Admiral von Tegetthoff sent on these despatches to the Ministry of War at Vienna, and to Field-Marshal-Lieutenant Baron Maroičić at Görz, adding: "Think, therefore, should not go to the S. E., since this may be a demonstration of Italian ships to entice the squadron away from here. Beg, nevertheless, for intimation of views as to how squardon should act in face of such news. Salamander makes much water, and is obliged to go to Pola." Von Tegetthoff, who, I think, had previously made up his mind that the Italians meant to attack some part of the coast or islands, desired, apparently, that they should not attack Pola during his absence from his base, and that they should attack one of the numerous tempting points among the islands.

18. At about 2 P. M., other despatches came in from Lissa. One, sent off at 10.10 A. M., was: "Ships, already signalled, manœuvering N. W., colors down. Am preparing for action." A second, despatched at 11.45 A. M., was: "Ships already signalled approaching Lissa, distant ten miles." A third, despatched at 12.20 P. M., was: "Comisa attacked by twelve ships, Sardinian colors."

19. The last of these telegrams was forwarded to the Ministry of War by the rear-admiral with the addition: "I maintain my former view. Request orders, seeing that Lissa is very far removed from probable main point of attack." In other words, he could not then believe that the enemy would be so foolish as to risk himself against so unimportant a point. The idea seemed too good to be true. To the officer commanding at Lissa, von Tegetthoff telegraphed an inquiry as to the nature of the hostile vessels, in order that he might form an opinion about the real intention of the Italians. Soon afterwards there reached him the brief despatches: "Harbor of Lissa attacked" (12.40 P. M.), and "Hot artillery action at Lissa, without damage" (1.15 P. M.). Further telegrams, received in the course of the afternoon, gave a bald description of the progress of the engagement, and at 11 P. M. came the reply of the Commander-in-Chief of the Southern Army to von Tegetthoff's repeated enquiries as to what portion of the coast was, in the circumstances, to be most carefully guarded, and as to what was to be done to that end? The answer was: "Do not venture on any division of the squadron, and frustrate as far as possible every attack on the coasts of Istria and Triest." On the morning of the 19th, news arrived that the fighting at Lissa had been renewed; that the whole Italian fleet was engaged there, and that, therefore, no operations could be simultaneously intended against any other part of the coast.

20. Rear-Admiral von Tegetthoff thereupon determined to sail; to fall upon the enemy while thus engaged, and, incidentally of course, to carry out his orders by frustrating the attack on Lissa. He communicated his decision by telegraph to the Ministry of War and to the Commander-in-Chief of the Southern Army, asking for speedy replies; received his captains on board the flagship at 10.30 A. M., in order to make them acquainted with his plans, and at 10.45 A. M. signalled: "Light all fires," and "Ships that have steam will weigh." The Vulcan was directed to tow all lighters, etc., to Pola, and, with the Santa Lucia and Triest, to place herself at the disposal of the port authorities, who were to take measures for the shipping, as rapidly as possible, of 1000 tons of coal; and the Stadium took up a position under Fort Brioni, there to await the telegrams which were expected at 2 P. M., and to carry them to the fleet. Von Tegett-

hoff's anxiety with regard to coal contrasted strangely with Persano's short-sightedness with respect to this need of his ships.

21. A large number of the ships had already proceeded to sea when instructions reached the rear-admiral from the Ministry of War to act according to his own judgment, but not to go out in consequence of a mere demonstration against Lissa. It was no longer, as every despatch from the island proved, a question of a mere demonstration; and at noon the flagship quitted Fasana Roads. At 1.30 P. M. she had joined the rest of the fleet in the offing, and, a little later, amid the strains of the National Hymn and the thundering cheers of the ships' companies, who thronged the hammock-nettings and the shrouds, the Ferdinand Max took her place at the head of the line.

II. Preliminary Movements of the Italians.

22. Having now described the preliminary movements of the Austrians, I may fitly, before dealing with the attack on Lissa and the subsequent battle off that place, say something about the preliminary movements of the Italians.

23. The Italian Admiral, Count Carlo Pellion di Persano, who, as early as June 8 had, in view of the outbreak of hostilities, been ordered "to sweep the enemy from the Adriatic, and to attack and blockade them wherever he should find them," was, on June 20, telegraphically apprised by Signor Agostino Depretis, Minister of Marine, of the declaration of war, and directed without delay to proceed to Ancona with the ships (including nine ironclads) which were then at Taranto.

24. Persano, in consequence, quitted Taranto on June 22 with nineteen vessels, but as his slowest ship was not capable of a speed of more than five knots an hour, did not reach the harbor of Ancona until the 25th. On the same day he addressed to the Ministry of Marine a note on the wants of the fleet, particularly specifying telescopes, despatch-boats of greater speed than he possessed, as many Armstrong guns as possible, and more ironclads. The ministry complied in a few days with the most pressing and most readily granted of these requests, but declined the application, which, in view of the composition of the Austrian fleet, appeared to be somewhat unreasonable, for more ironclads.

Persano already had with him three more than von Tegetthoff, whose force practically represented the whole Austrian navy.

25. The departure from Taranto had interfered with the new arming of the ships, but this was resumed with great energy at Ancona, and the three ironclads, Re d'Italia, Palestro and Varese, were each supplied with two 150-pdr. (8-inch) Armstrongs.

26. On June 27, when the Austrian squadron appeared before Ancona, only one vessel was still engaged in changing her guns, but she, also finally took on board two weapons of the new pattern. The remaining craft were busy coaling, or were attending to the last of their repairs. The approach of the enemy was promptly remarked by the despatch-vessel Esploratore, Commander Cav. Orengo, and at 4 A. M. was signalled to the fleet.

27. Upon the admiral, who had gone on board the Esploratore, signalling "assetto di combattimento," all the ships prepared for action, and, in two hours, ten ironclads, four frigates, one screw corvette, one paddle corvette, three screw gunboats, and the paddle despatch-vessel were ready to engage. The ironclads Maria Pia, San Martino, Principe di Carignano and Castelfidardo, were the first to proceed into the roadstead, and later at the order of Admiral Persano, most of the others went in the direction of Monte Conero, two miles from the port, so as to take their places in line of battle under the protection of the shore batteries. This manœuvre gave the Austrian fleet time to withdraw absolutely unmolested by its greatly superior enemy. Persano's interpretation of the order to sweep the Austrians from the Adriatic, and to attack and blockade them wherever he should find them ought, I think, to have led to his instant supersession by Depretis.

28. At a conference held later on board the Principe di Carignano with Rear-Admiral Vacca, d'Amico, Chief of the General Staff, and Captains Jauch and Bucchia, Admiral Persano declared that he had not attacked the imperial fleet because three of his ironclads, the Re d'Italia, Re di Portogallo and Ancona, would not have been able to participate. Even without them, however, his force, especially in gun power, would have been vastly superior to that of von Tegetthoff. All his actions at the time tended to undermine the morale of his people, and the confidence of his officers in himself and themselves. Moreover, it was not a fact that the Re d'Italia and Re di Porto-

gallo could not have participated. He is also understood to have intimated that his instructions assigned to him more important operations—that he had orders not to risk the fleet—and that he looked for no advantage to result from following the foe. It is evident, not only that Persano misrepresented his intsructions, but also that he was so strategically blind, and so morally timid, if nothing worse, that he was practically paralyzed. It is known, too, that the reverses which had been already suffered by the Italians on shore had taken the heart out of him.

29. In his despatch to the Ministry of Marine, Persano put forward the necessitous condition of several ships as a reason for his inactivity on that day, but added that the fleet would be ready in a short time to attack the enemy, who, so soon as he had observed the formation of the Italian fleet, had taken to flight in the direction of Pola.

30. Although on the 28th of June it was reinforced by the screw frigate Vittorio Emmanuele, the screw corvette San Giovanni and the paddle despatch-boat Sirena, the Italian fleet remained for another ten days at anchor at Ancona, occupied solely in completing the equipment of the ships, and in putting itself into fighting order. Persano, unfortunately, had not the art, possessed in the highest degree by Saumarez and Nelson, of inspiring his people, and of getting good work out of them even on the darkest days. His example only increased their lack of confidence.

31. On July 5 France began diplomatic intervention, which the Italian Government, hesitatingly and without relaxation of hostilities, accepted. Impressed by the importance, at that junction of a decisive action, and prompted by the voice of the people, the Minister of Marine on July 5 telegraphed as follows to Admiral Persano: "The most serious considerations call for the hastening of the complete equipment of the fleet. I have despatched the Carlo Alberto, Principe Umberto (screw frigate), and Governolo (paddle corvette) from Naples, and ordered the immediate completion of the Affondatore. Inform me as to when the fleet will be ready to go to sea, and of what vessels it will consist." It should be explained that the Affondatore, lately built in England, had quitted Gibraltar on June 28 and proceeded with all possible speed to Naples.

32. A second telegram of the same day ran: "The proposals

of the Emperor of the French do not hinder the prosecution of hostilities; on the contrary, an action with definite result would be useful. The hastening of the equipment is pressing."

33. Thereupon Admiral Persano replied: "If the matter be pressing, the fleet is completely ready to put to sea; but two days are yet needed if the guns are to be embarked and the carriages fitted. The other needs are secondary. But I desire instructions, for I have none of any value except those of June 8." It might be thought that these were explicit enough and all-sufficing (see §23). Persano's telegram surely savored of impertinence.

34. Having received this message, the Minister of Marine, on the same day, telegraphed: "Let the fleet put to sea to-night, and do you await at sea those ships which are still engaged in getting their guns on board. Despatch is necessary."

35. The definite and specific instructions which had been asked for were thus given; yet, in spite of the urgent nature of the order and its precise wording, the fleet did not leave its anchorage. In a telegram of July 6 to the Minister of Marine, the admiral, while declaring that, except as regards the new guns, he was ready, requested more directions, using the following words: "I beg you to state definitely whether I am to attack the enemy should he be protected by fortresses. It would be better if the Affondatore were here; yet I will proceed without her. You know the situation, and will, therefore, be able to say whether an action will be sufficient, or whether a definite result is required." It is pitiful to find an officer, who was afterwards acquitted of cowardice and treason, shilly-shallying in this manner.

36. The Minister of Marine reiterated his urgent orders that the fleet should instantly leave the roadstead of Ancona, and repeated that it was important to fight the enemy and to beat him. To attack fortresses before the Austrian fleet should be defeated was not deemed to be desirable. Such an attack was indicated as an operation which, after a victory won, might be rendered advisable by circumstances, and by the results attained and to be attained. The strategy then outlined by Depretis was perfectly sound; but the judgment of a minister who could still continue Persano in command must have been at fault, and that it was so is shown by the minister's feeble change of strategy on July 15 (see §41).

37. The interchange of these despatches occupied three days; and still the fleet did not sail. On July 7 fresh orders arrived from the minister. These were to the effect that:

a. Persano was to seek the enemy, attack him in accordance with the instructions of June 8, and press the action to the utmost in order to secure a decisive result.

b. Should the enemy's fleet remain in Pola, or should it take refuge there, Persano should blockade Pola with an adequate force, but remain out of gunshot of Pola and of the works protecting the roads of Fasana.

c. The main object of the naval operation was, before all other things, to obtain command of the Adriatic, by freeing that sea from the Austrian fleet. Should Persano encounter that fleet, he was to follow it, attack it and beat it, or at least drive it into port, and there block it up in such a way as would prevent it from issuing forth again.

38. At length, at 4.30 P. M. on July 8, the fleet, with the exception of a few vessels which were still completing for sea and which remained behind under Rear-Admiral Provana, received the order to sail, not, however, that it might go in search of the enemy, although it is true that Admiral Persano specified this as the object of his operations. The fleet quitted the harbor at 6 P. M., and having arrived off the Gulf of Quarnero at 9 A. M. next day, returned again towards Ancona, so that by 2 P. M. it was about 40 miles to the S. E. of Monte Conero. This was the rendezvous that had been given to Rear-Admiral Provana. On the following day it stretched over towards the Dalmatian coast, approaching Isola Grossa and Lissa within about twenty-five miles, but then retiring again to sea, and exercising at steam tactics, signalling and gun-drill, yet not firing, in spite of the fact that many of the newly mounted guns had, of course, never been fired on board ship, and were strange to the people.

39. In this manner, distant alike from the coast of Italy and from that of Dalmatia, and as invisible to friend as to foe, the fleet manœuvred for three days on the line of 43° 11′ N. Having expended a great deal of coal, the loss of which could not be made good at sea, and not having sighted the coast of Venice or Istria, much less the enemy, it returned to Ancona early in the morning of July 13 and relapsed into its former inactivity regardless of the will of the Minister of Marine, who, foreseeing

that it must come back to replenish bunkers had, on the 10th and 11th of July, forwarded to Ancona two despatches, requiring Persano to fill up in the shortest possible time, to go to sea again and to carry out his instructions.

40. Admiral Persano evidently considered himself to be still too weak to attempt decisive action against the imperial fleet, and his three days' experimental cruise in the Adriatic seems to have convinced him that, before risking an engagement, further exercises were very necessary; nor can it be pretended that the Italian fleet, even at that period, was in the condition of perfection which, at the beginning of the mobilization, the Marine Ministry had considered it should attain ere it could successfully engage the Austrians. Persano was not the man to correct the shortcomings in discipline and training. On the other hand, the dockyard authorities, it must be admitted, were much to blame. The fleet was to have consisted of thirty-five vessels. Of its twelve ironclads, the Affondatore; of its heavy wooden vessels, the screw line-of-battle ship Re Galantuomo, the screw frigates Carlo Alberto and Principe Umberto, the paddle corvettes Governolo and Fulminante, and the screw corvettes Clotilde and Etna; and of its small craft, two despatch-vessels, one brigantine, and several transports, were absent. In fact, of the thirty-five men-of-war, inclusive of armed despatch-vessels, which had been intended to compose the active naval force, eleven were not upon the spot, so that on July 14 the fleet included only eleven ironclads, five screw frigates, one screw corvette, two paddle corvettes, three screw gunboats, and two despatch-vessels. Thus, leaving aside considerations of tonnage, engine-power, armor and armament, and looking merely at numbers, the Austrians were inferior as regards big ships, only by four ironclads and one heavy wooden vessel, and they actually had a superiority in the matter of gunboats. In other material respects, and particularly in gun-power, the Austrians were, it is true, at a great disadvantage; but Persano seems to have doubted whether (looking to the supposed probability that the enemy, if he fought at all, would fight in the neighborhood of a well-fortified harbor), all the superiority possessed by the Italians would justify them in hoping for a decisive result from an engagement. He judged von Tegetthoff by his own poor self. He therefore wished to await the arrival of a few more ves-

sels, and especially of the ram Affondatore. Nearly all his letters and despatches mentioned this ship, and urged the hastening of her junction with the fleet. The inactivity of the admiral was, nevertheless, so unwelcome to the people and the government, that the Minister of Marine deemed it wise to betake himself personally to Ancona in order to goad Persano to begin hostilities by means of a hint that otherwise he must be relieved of his command.

41. The Minister of Marine arrived on the morning of July 15, summoned d'Amico, the chief of the general staff of the fleet, and asked him whether he held that a sudden descent on Lissa offered prospects of success. D'Amico was of opinion that, as the conclusion of a truce seemed to be imminent, neither Venice nor Pola could be attacked; but that if it were required to deal some swift blow, no place was more suitable than Lissa as a scene of operations. Rear-Admiral Vacca, who was present, agreed with this opinion. A little later the project of a suitable descent on Lissa was put before Admiral Persano who, raising no objections, required only that a landing force of four or five thousand men should be placed at his disposal. Neither minister nor admiral seems to have raised a question as to the whereabouts of von Tegetthoff, or as to the probable attitude of his undefeated fleet. It seems to have been concluded that, because the Austrians had not attacked the Italians under the batteries of Ancona, they would not attack them anywhere. Indeed, Persano's feeble mind swung over readily from the extreme of moral timidity to the extreme of insensate rashness; and he finally went out on his mad expedition without an ounce of coal save what his ships had in their bunkers—coal, that is, sufficient only for four or five days' steaming—though he realized clearly enough that he was not in the least likely to capture Lissa in a day or to find any fuel there.

42. On the same day there arrived from the headquarters at Ferrara a memorandum by General La Marmora. This had been despatched by order of the king, and it admitted of no further postponement of operations. As the Minister of Marine undertook to strengthen the available landing force by 1500 men at once, and to send without delay further reinforcements of one battalion of marine infantry, two companies of engineers, and 1500 chasseurs, under the command of General Fontana,

Persano determined to sail on the following afternoon for an attack upon Lissa.

III. Lissa and its Defences.

43. Lissa is a mountainous island, forty miles from the Dalmatian mainland, and having between it and the mainland the islands of Lesina and Brazza. It is about eleven miles long from east to west, and six miles broad from north to south. The western extremity, splits into two promontories, between which lies the Bay of Comisa, with the town of Comisa at its head. Near the northeast extremity, at the head of Port St. Giorgio, lies the town of Lissa. At the southeast corner of the island is Porto Manego. The whole coast is much broken and lofty, and some of the interior peaks have an elevation of nearly 2000 feet.

44. The island was for some time, during the Napoleonic wars, occupied by the British, who fortified it, and when it was restored to Austria, the fortifications were repaired and improved.

45. Port St. Giorgio, which is about one and a half miles long and half a mile broad, runs inland in a westerly direction. On the north side the approach, at the beginning of 1866, was protected by Fort Georg and the smaller works, Battery Marmula, Robertson Tower, Battery Zupparina and Bentinck Tower, all of which stood on the small promontory which juts out between Port St. Giorgio and Porto Karober. On the south side, at the narrowest part of the entrance, stood Battery Schmid, with Wellington Tower above and behind it. At the head of the harbor was Battery Madonna. All the works, save Wellington Tower, which had fallen into decay, were in good order, though they were not modern, and had been constructed only to cope with wooden ships. In addition to them, upon the highest point of the road between Port St. Giorgio and Comisa was a work known as Fort Max.

46. Just before the outbreak of the war Bentinck Tower and its outlying defences were strengthened; Wellington Tower was repaired; Battery Magnaremi was erected on the north side of the mouth of the Bay of Comisa; a work was thrown up on Monte Perlić on the side of the same bay; two works were completed on the Vrani Kamić to dominate the N. W. corner of the island, and Battery Nadpostranje was built above Porto

Manego. Finally, above and behind Battery Madonna, at a height of about 800 feet, seven emplacements were made and armed on the hills of Andrea and Cosmo. The island was united by means of a telegraph cable with Lesina and Brazza, and could also communicate with those islands by means of optic telegraphs, or semaphores, placed on the peaks.

47. The various works which have been briefly catalogued were armed as follows:

	60-pdr. Mortar.	48-pdr. S. B. M.	30-pdr. Mortar.	30-pdr. Howitzer.	30-pdr. Shell Gun.	24-pdr. R. B. L.	24-pdr. M. L.	18-pdr. S. B.	12-pdr. R. B. L.	12-pdr. S. B. M.	10-pdr. Howitzer.	7-pdr. Field Howitzer.	7-pdr. Shell Gun.	6-pdr.
Fort Georg	2	6	1	..	..	4	..	4	..	..	..	..	..	..
Battery Mamula	..	..	1	4	..	2	..	..	..	..	..	..	..	..
Robertson Tower	..	..	..	..	..	..	..	..	1	..	..	..	..	..
Battery Zupparina	..	..	..	..	..	4	..	..	..	..	..	..	..	..
Bentinck Tower, etc.	..	..	..	2	..	..	..	..	1	4	..	..	..	..
Battery Schmid	..	2	..	..	..	2	..	..	..	..	..	..	..	..
Wellington Tower, etc.	2	..	2	..	..	..	..	..	..	..	1	1	..	..
Battery Madonna	..	..	..	..	4	4	..	..	..	..	..	..	..	..
Fort Max	..	..	..	..	..	..	2	..	..	..	..	..	2	..
Battery Magnaremi	..	..	..		..	4	..	..	4	..	..	..	..	..
Monte Perlić	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Battery Nadpostranje	..	..	..	..	..	..	..	4	2	..	..	..	..	..
Cosmo-Andrea	..	..	..	..	..	..	..	4	..	..	..	..	..	4
Reserve, etc	..	..	..	..	..	..	..	..	..	2*	..	..	..	4*
	4	8	4	6	4	20	2	12	8	6	1	1	2	10

The Austrian pound equalled 1.2347 lb. avoirdupois.

* These were not guns, but 12-pdr. and 6-pdr. rocket-tubes.

48. The garrison of the island, after the transfer on the 12th or 13th of July of the 4th Jellačić Battalion to Triest, consisted of:

	Men.
5 Companies of Marine Infantry	1200
Company 3 of the Coast Artillery Regiment	297
Company 5 of the Coast Artillery Regiment	265
Engineers	27
Seamen	44
	1833

The whole was under the command of Colonel Baron Urs de Margina, who also had at his disposal in Port St. Giorgio the steamer Egitto, which, however, was unarmed.

* * * * *

On July 16 the Italian fleet left Ancona for Lissa. It t consisted of the eleven ironclads Re d'Italia (flag), Re di Po gallo, Principe Carignano, Maria Pia, Castelfidardo, Anc San Martino, Formidabile, Terribile, Palestro and Varese; four screw frigates Maria Adelaide, Gaeta, Duca di Genova Vittorio Emanuele; the three corvettes Guiscardo and Et Fieramosca (paddle) and San Giovanni (screw); the two ar despatch-vessels Messaggiere and Esploratore; the two h despatch-vessels Flavio Gioia and Stella d'Italia; the Washi ton, hospital-ship, and the Indipendenza, store-ship. Later in day, the three screw gunboats Montebello, Vinzaglio and C fienza, and the unarmed despatch-vessel Giglio joined. screw frigate Garibaldi, which had remained behind to atten her machinery, picked the fleet up on the 18th, and the l desired ram Affondatore reinforced Admiral Persano on 19th.

IV. The Italian Attack on Lissa.

49. As the fleet was without a trustworthy chart of Lissa, which the commander-in-chief had applied in vain to the M istry, Captain d'Amico, the chief of the general staff, was on board the Messaggiere to undertake a reconnaissance.

50. In order to conceal its real object, the fleet headed t nightfall for the island of Lussin in the Gulf of Quarnero, on the 17th altered course, and on the 18th, at 8.30 A. M., peared for the first time in sight from the island of Lissa, dis about twenty miles to the N. W. In the meantime, on the 1 at sunset, the Messaggiere which, under British colors (see § had cruised round the island, had rejoined the flag, and Cap d'Amico had given the admiral a tolerably correct, though so what general, account of the works on shore. These he sketched in on a previously prepared map, and he had repo that, according to his estimate, they were held by about 2 men. It does not appear that the Italians had satisfied th selves as to the whereabouts of von Tegetthoff.

51. Persano, who had originally intended to appear with bulk of his fleet before St. Giorgio, and, while he attac the harbor, to disembark his troops at Comisa, and to ma them thence so as to take the St. Giorgio defences in the r now realized that a landing at Comisa would inevitably r

1866.

I. Lesina

From Der Kampf auf dem Adriatischen Meere im Jahre 1866.
Wien, 1869, *Verlag des k. k. Generalstaten in Comm. bei C. Gerold u. Sohn.*

with difficulties. He did not, however, regard the island as a Gibraltar. On the contrary, he considered that, though the operation might take time, and might not perhaps be completed until after the arrival of the promised reinforcements for landing purposes, the capture of the place was perfectly practicable. But as he now purposed to make Manego his chief point of disembarkation, he modified his plan of attack and made his dispositions as follows:

52. *a.* Rear-Admiral Vacca, with the three ironclads, Principe Carignano, Castelfidardo and Ancona, and the paddle corvette Guiscardo (mounting in all eighty-two guns), was to attack the works in the bay of Comisa, so as to occupy the attention of part of the garrison, and, by reducing the batteries, to afford the expeditionary corps a possibility of landing there in case a landing should not be effected elsewhere.

53. *b.* Vice-Admiral Albini, with the four screw frigates Maria Adelaide, Gaeta, Duca di Genova and Vittorio Emanuele, and the screw corvette San Giovanni (mounting in all 206 guns), was to silence Battery Nadpostranje, which protected Porto Manego, and then disembark a landing force under Captain di Monale.

54. *c.* The bulk of the fleet, consisting of the ironclads Re d'Italia, Re di Portogallo, Maria Pia, San Martino, Formidabile, Terribile, Varese and Palestro, the paddle corvette Ettore Fieramosca, and the despatch-vessel Messaggiere (mounting in all 173 guns), under the personal command of the admiral, was to attack the works of Port St. Giorgio from the front. The four ships Re di Portogallo, Maria Pia, Terribile and Varese, under Captain Ribotti, as senior officer, were told off to the defences on the south and east side of the harbor mouth, while the rest, under Persano, were assigned to the defences on the north and west side.

55. *d.* The gunboat flotilla (mounting 12 guns), under Commander Sandri, was to proceed to Lesina, there cut the submarine cable, and destroy all vessels, and other means of communication with the mainland.

56. *e.* The Esploratore was to cruise between Punta Planca (called in many charts, Punta Blanca, on the mainland) and the island of St. Andrea, and the Stella d'Italia between St. Andrea and the island of Pelagosa, and to signal any approach of hostile ships. By this arrangement Lissa was placed about 20 miles

inside the point of a right angle formed by the lines upon which the two vessels were instructed to cruise.

57. *f.* The Indipendenza and Washington were to lie off the island of Busi, about five miles to the southwest of the island of Lissa and to await orders.

58. These dispositions were to have taken effect at daybreak on the 18th, but owing to various reasons, it was not until between 10 and 11 A. M. that the vessels began to reach their stations.

[In my humble opinion, the plan, apart from the damning defects of the main strategy which allowed of its being employed at all, was not a sound one. Persano's idea was, with his ships, to occupy attention at two distant points while a landing was being effected at a third and intermediate point. Ships do not necessarily occupy much of the attention of the garrisons of forts of elevated command. The forts may wholly or partially neglect the ships, especially if there be no good landing place near. But an attempted landing is a real threat. Persano, therefore, should have concentrated his heavy ships and divided his landing parties. Such was the plan which was adopted with conspicuous success more than once by the Japanese in their war with China in 1894-5. Moreover, Persano ought to have known the futility of expecting ships to deal successfully with works perched far above them.]

59. Reinforced by the Garibaldi, which had joined at 9 A. M., and which was assigned to Albini's division, the fleet approached the island. The garrison had been forewarned by the Messaggiere's reconnaissance on the morning of the 17th that something was intended against it, and a good lookout being kept, the telegraph station on Monte Hum was able, soon after sunrise, to signal that nine men-of-war, distant twenty miles and flying no colors, were steering a N. E. course towards Lissa (see §16). Little by little more ships were sighted, until twenty-two were counted. At 9 A. M. they were visible from Battery Magnaremi, near Comisa, and at 11 A. M. Ribotti's four ironclads, coming from the S. W., approached within gunshot. Magnaremi opened promptly, and all the ships at once hoisted Italian colors and dressed themselves with flags. The four ironclads took station to the N. W. of the battery and opened fire upon its right flank, which contained the powder-magazine. Magnaremi at first

replied with the three rifled 24-pdrs. of the flank attacked, but to strengthen the fire, the commanding officer caused the guns from the left flank to be run across and fought over the top of the magazine. The enemy, surprised by the increased fire, altered his position. At the same time, Vice-Admiral Albini's wooden ships appeared, took station in front, and on the left flank, of the battery, and engaged. Soon afterwards Rear-Admiral Vacca's ships also joined in the action.

60. Magnaremi, thus for a short time assailed by fourteen ships, behaved very creditably, and never slackened its fire; but the Italians had great difficulties to contend with, for the battery was not only small, but also about 500 feet above the sea-level. At first the projectiles did not reach the height; later they overshot it. Only two in all struck the scarp of the work. Whenever any ship moved within range of them, the two 6-pdr. La Hitte guns, posted 800 feet high on Monte Perlić, were fired; but it cannot be supposed that such little weapons did much harm.

61. After the arrival of the division of Rear-Admiral Vacca, who thenceforward took charge of the action at Comisa, Albini and Ribotti drew their ships out of fire, and steered along the southern shore of the island, the former for Porto Manego, and the latter for St. Giorgio. Admiral Persano, with his ships, seems to have proceeded to St. Giorgio by way of the northern side of the island. At 11 A. M. Ribotti's division, in column of line ahead, passed Manego, and, when Battery Nadpostranje fired a blank charge, the three leading vessels altered course to starboard and made a wide bend which took them out of gunshot. The fourth vessel drew nearer, and two shotted rounds were discharged at her, but failed to hit her. Thereupon she also, without making any reply, kept away and followed her consorts around the eastern side of the island.

62. A little later Vice-Admiral Albini's wooden ships appeared before Porto Manego and took station opposite Battery Nadpostranje. The Maria Adelaide and Vittorio Emanuele approached within range and opened with their heaviest guns, but failed to reach the work, which lay about 500 feet above the sea. Nadpostranje replied with twenty-eight rounds, which killed two and wounded three people on board the Maria Adelaide.

63. In the meantime, arriving from the westward, the first of Persano's iron-clads approached within range of Fort Georg at about 11 A. M. Fired at by that work, they passed it without replying, but presently stationed themselves in such a manner as almost to surround the fort and began a furious action, in which Ribotti's division, coming in from the eastward and taking position opposite Wellington Tower and Battery Schmid, soon joined. While the ironclads, kept in continual motion, rained heavy projectiles on the forts, the latter returned the fire with steadiness. Aware of the small size of the guns on shore, the enemy often ventured within 1500 yards of the defences. The flagship Re d'Italia, at length placed herself within 500 yards of Battery Schmid, which, only forty feet above the sea, tried in vain to drive off its formidable opponent, and, at about 2 P. M., Battery Schmid's magazine blew up, burying forty men in its ruins. It was the Italian flagship that, by a fortunate shot, had wrought this damage, and cheers from all the ships greeted the success. Soon after the explosion in Battery Schmid, several small magazines blew up in Fort Georg, and Batteries Mamula and Zupparina, and, especially at Fort Georg, occasioned much loss; but nowhere did the defence lose heart, and a continuous fire was kept up. Wellington Tower was particularly active, and Admiral Persano therefore ordered the Maria Pia, San Martino and Formidabile to draw nearer to it and to bombard it as hotly as possible.

64. While eight ironclads were thus engaged in endeavoring to silence the defences of Port St. Giorgio, the paddle corvette Guiscardo arrived from Comisa with a message from Rear-Admiral Vacca to the effect that, owing to the inaccessible elevation of the Austrian works there, he had ceased to bombard them and was on his way to Porto Manego, where he purposed to support Vice-Admiral Albini. Vacct had, in fact, suspended his bombardment at 1 P. M. When he arrived off Manego, he discovered that Albini was inactive for reasons similar to those which had operated at Comisa.

65. A council of war, assembled in Albini's flagship, the Maria Adelaide, had already unanimously recognized the uselessness of continuing an engagement which, while it involved loss and damage to the wooden ships, seemed to promise no result, and it was in doubt as to the advisability of attempting to land troops.

Vice-Admiral Albini despatched the screw corvette San Giovanni with this intelligence to Admiral Persano, from whom he requested further orders. Vacca, informed of the condition of affairs at Manego, steamed on with his division for Port St. Giorgio.

66. Admiral Persano was in no small degree surprised at the resultless nature of the operations of his subordinates, and made a communication in writing to that effect to Vice-Admiral Albini. This was, perhaps, natural, for it is difficult to imagine that the small and loftily placed works dominating the south coast of the island could have been of sufficient force to prevent a seriously attempted landing of troops, or to bar their advance towards Lissa. It is disappointing, too, to any commander-in-chief that subordinates, instead of sending for fresh orders, should, on their own responsibility, abandon the positions and duties assigned to them.

67. At the same time Persano sent orders to Albini to join the main ironclad division, and to Vacca, to keep at least one ironclad before Comisa in order to hold the local garrison in check. Shortly after the despatch had been sent off to him, however, Vacca appeared off St. Giorgio, and Persano then instructed him to direct the fire of his division simultaneously against Wellington Tower and the inner defences of the harbor. About half an hour later, Albini's division also joined the fleet, and was ordered to effect a landing in Porto Karober, which lay close at hand.

68. While Albini made the necessary preparations to this end, every ship concentrated the greater part of her fire on Battery Madonna, Wellington Tower and Fort Georg, which, not having been built to withstand such a storm of projectiles, suffered severely.

69. In the meantime Albini's vessels, covered by the projecting peninsula known as Scoglio Ost, took station off Novaposta in such a manner as to expose themselves as little as possible to the guns on the weak left face of Fort Georg. At 5 P. M., the fort which, during a six hours' action, had lost one-fifth of its garrison, had had half its guns dismounted, and had been, in places, razed level with the ground, and which, at the last, had to contend with no fewer than 433 guns, ceased firing. Battery Mamula, which lay beneath the fort, and was exposed to the

same destructive hail, lost its commandant, Gomola, and a third of its garrison, and was silenced soon after Fort Georg had become quiet.

70. The Italians quickly perceived the effect of their fire and unwisely resolved to force the harbor. In view of the fact that a landing had been ordered at Karober, there was no reason for attempting to do all the work with the ships. The Formidabile was ordered to plant herself in the entrance, and the Maria Pia and San Martino were directed to proceed into the bay and engage the batteries there. Some of the remaining ironclads approached the mouth of the port, and, with the paddle vessels, which up to that period had been kept at a distance but were now brought nearer, were instructed to throw their heaviest projectiles up the harbor, while the Re d'Italia placed herself in front of the still almost undamaged Battery Zupparina.

71. Suported by the fire of these craft, the Formidabile, followed by the Maria Pia and the San Martino, moved slowly and cautiously into the bay under the guns of Wellington Tower of Bentinck Tower, and, more effective than all, of Battery Zupparina, which, paying no attention to the other vessels, concentrated all her guns upon the ships that were on their way in. Arriving opposite Zupparina, the three iron-clads discharged their broadsides at the battery, which, however, at a distance of barely one cable, continued steadily to direct her projectiles at their ports, and thus managed to get a 24-lb. shell into the interior of the Formidabile, the leader of the line. Intimidated, perhaps, by the resultant explosion, the Formidabile suspended her advance, and as the hitherto untouched Battery Madonna at that moment joined in the action, the three ironclads, which had already passed the line between Battery Zupparina and Battery Schmid, began to haul off.

72. When the enemy made this mad and unnecessary attempt, the hired Austrian Lloyd steamer Egitto, which had been placed under the orders of the commander of the island, and which seemed to be threatened, was sunk in shallow water up to the level of her upper deck, and the troops, which had until then occupied the hamlet of Lissa, were withdrawn to the heights of Andrea and Cosmo, while all the available field-guns were put in position behind the emplacements on these heights with a view to the support of Battery Madonna.

73. Hitherto the cable to Zara had been in working order, and, by means of it, all occurrences had been reported; but after the despatch of the message announcing the catastrophe at Battery Schmid, the wire suddenly became useless. The explanation is that at 4 P. M. a gunboat belonging to Commander Sandri's flotilla (see §55) had entered the harbor of Lesina, had taken the harbor officials on board, and, by threatening to bombard the town, had induced the local authorities to discover the position of the cable, which had been then cut.

74. After the failure of the attempt to force the port, it seemed to the Austrians as if the enemy determined to destroy Wellington Tower, so as to complete the silencing on that day of the outer defences, even if the inner ones could not be reached. At 6 P. M. all the ironclads were concentrating their fire upon the tower, which, together with the adjoining mortar battery, 600 feet above the sea, was exposed to a close bombardment for two hours. The defence was assisted by Bentinck Tower, and also by Battery Zupparina, whenever any vessels showed themselves within range of the guns of that work. Wellington and the mortar battery replied as warmly as they could to the enemy's more numerous projectiles, many of which flew far over the tower, and, falling, set the hillside undergrowth in flames.

75. It was after 7 P. M. when Admiral Persano, realizing the necessity of giving his men some rest, collected the greater part of his fleet in line, out of gunshot, to the north of the harbor. For a time he left Vacca's division before Wellington, which, on the north side, had been somewhat seriously breached, and the safety of which was thus imperilled. Nevertheless, the howitzers on the summit of the tower, and the mortars below it, were still firing when, at about eight o'clock, Vacca's division drew off, and with the rest of the fleet, dropped anchor after sundown eight miles to the northward of the coast.

76. At 10 P. M. the gunboat flotilla from Lesina rejoined the flag, and Commander Sandri reported to the admiral that, shortly before the cable had been cut, a despatch had gone through to the effect that the Austrian fleet might be expected off Lissa. This news, which Commander Sandri declared that he had obtained from an Austrian official, appeared to Admiral Persano to have been invented in order to deter him from prosecuting his attack upon the island, and he decided that, on the following

day, the 19th, although he would keep the greater part of his fleet ready to ward off any Austrian interference that might be attempted, he would resume the engagement with the works on shore, and would again endeavor to effect a landing in Porto Karober. It is clear, I think, that Persano was not a student of naval history. Had he been one, the mere fact of Lissa being near him must have recalled to him how narrowly Dubourdieu, in 1810, had escaped being caught by Hoste at a disadvantage while in the act of seizing part of the island. It would also have reminded him that Dubourdieu, in 1811, sailed from Ancona to capture Lissa without having first reckoned with the undefeated British squadron in the neighboring waters, and that, in consequence, he was disgracefully beaten by Hoste with a very inferior squadron. History sometimes repeats itself with startling simplicity. The officers commanding the landing force, the artillery and the engineers, were summoned on board the flagship and agreed with Persano's decision; but they expressed some doubt as to the success of the undertaking until reinforcements should arrive. The paddle-corvette, Ettore Fieramosca, with despatches concerning the day's work, was sent from the fleet, and in the dead of night some other vessel appears to have approached the Bay of Stončica in order to reconnoitre, for at 12 o'clock Wellington suddenly fired a shot in that direction, disturbing the numerous working parties that were repairing the sorely damaged defences. But if a ship did indeed approach, she quickly retired again, and from midnight until morning there was no further alarm.

77. During the hours of darkness Admiral Persano's timidity and infirmity of purpose tormented him with doubts whether, after all, his available troops, which all his advisers believed to be insufficient for the business, ought to be landed on the little known territory of the enemy, and finally he came to the conclusion that he would await reinforcements. On the morning of the 19th, however, he ordered Vice-Admiral Albini and Rear-Admiral Vacca to proceed with the bombardment of the works, pending the time when a landing could be made. Already he had expended a large quantity of ammunition, only to discover that the Austrians repaired damages quickly. He was now about to expend more, although he had no means of knowing when he would be able to recoup himself, or that he would be

in condition to profit by the expenditure ere the defenders should again patch up their works. Unless a bombardment be designed to be merely punitive or destructive, it should not be carried out until circumstances permit of its being instantly followed up.

78. At 7 A. M. on the 19th, the divisions of Albini and Vacca again approached Port St. Giorgio and bombarded Fort Georg and the works near it, Albini firing, merely for practice, at Wellington Tower also. Fort Georg, Robertson Tower, Battery Mamula and Wellington Tower, with its mortar battery, returned a few shots. The reply from Bentinck Tower and Battery Zupparina was more vigorous. At about 8 A. M. the Italians discontinued the bombardment. The ironclads steamed to the N. W.; the wooden ships proceeded along the coast towards Comisa. The latter, however, again approached St. Giorgio at 9.30 A. M., and from a position off Novaposta, opened against the left face of Fort Georg, the reserve magazine of which, containing about 55 tons of powder, was very ill protected, and was in great danger. Happily for the Austrians, the firing soon slackened again, until at 11 A. M. no great damage having in the meanwhile been done, all the vessels withdrew far out of range.

79. Shortly before that hour the expected vessels, the screw frigate Principe Umberto, with 125 men of the Marine Infantry on board, the screw frigate Carlo Alberto, and the paddle-corvette Governolo, had arrived. A little later came the ironclad turret-ram, Affondatore.

80. The reinforcements brought by these ships raised the strength of the landing party to 2600 men, and Admiral Persano, who no longer had any doubts as to the result, and who did not consider himself to be condemned to inaction or even to special caution, by any vague apprehension, founded upon mere hearsay report, that the Austrian fleet might appear, thought that the time had come to renew the attack, and, partly by heavy gunfire, partly by disembarking a strong force, to make himself master of the island.

81. He ordered, in consequence, the following arrangements:

a. The unarmored squadron, consisting of seven frigates and four corvettes, supported by the four gunboats, and commanded by Vice-Admiral Albini, was to land the troops at once in Porto Karober.

b. The iron-clads Terribile and Varese were to proceed to Comisa and to occupy the attention of the garrisons of the batteries there.

c. The Formidabile was to enter the harbor of St. Giorgio and to silence such batteries there as were still capable of fighting.

d. Rear-Admiral Vacca was to support the attack of the Formidabile with the ironclads Principe Carignano, Castelfidardo and Ancona.

e. The ironclads Re di Portogallo and Palestro were to attack Wellington Tower with their 300-pdr. and 150-pdr. guns.

f. The Re d'Italia, San Martino and Maria Pia, under the immediate orders of the commander-in-chief, were to hinder any attempts on the part of the works on the N. W. to interfere with the landing at Karober.

82. At 4.30 P. M. the Italian fleet approached the island, and again began to engage the works at Comisa and about Port St. Giorgio. At Comisa, the Terribile and Varese opened fire against the northern face of Battery Magnaremi. Presently two more ironclads probably the Re di Portogallo and Palestro, which had been assigned to the attack on Wellington Tower, arrived, and, after 6 P. M., these were joined by six wooden ships of Albini's division. While the ironclads aimed at the battery, the wooden ships directed their fire up the bay; but the good practice of the battery and guns on Monte Perlić kept at a distance the wooden craft, the projectiles from which did not reach the shore. As on the previous day, the engagement was a resultless cannonade.

83. After half an hour's firing, Albini's six vessels and two ironclads steamed off to Karober, leaving at Comisa only the Terribile and Varese, which prolonged the useless bombardment for another two hours.

84. Neither Magnaremi nor the guns on Monte Perlić received any considerable damage, and the obvious impotence of the enemy at Comisa enabled the greater part of the Marine Infantry there to be detached to Fort Georg and Bentinck Tower. Only an officer and forty men remained to take care of the guns on Monte Perlić.

85. More serious and bloodier work was being done in Port St. Giorgio. Soon after 4.30 P. M., the Formidabile began to discharge broadsides at Fort Georg, and, firing continuously, she gallantly went on until she was distant but a cable and a half

from Battery Mamula. For her support Admiral Persano ordered the Affondatore to fire her 300-pounders up the harbor, and at 5 P. M. the admiral, with the ironclads Re d'Italia, San Martino and Maria Pia, took the station which had been occupied by the Formidabile, and got into hot action with Bentinck, Wellington and Zupparina. At 5.30 P. M. such of Albini's wooden ships as were off Karober also engaged, and again imperilled the reserve magazine of Fort Georg and the rear of Battery Mamula. From time to time they also sent shots into the rear of Battery Zupparina and into the valley of Somogor, where a large powder magazine had a very narrow escape from destruction, several shells falling close to it, but not bursting. Wellington, which uninterruptedly threw shells at the ships, was little damaged, but most of the other works suffered severely.

86. By this time the Italians, in addition to having destroyed Battery Schmid on the previous day, had silenced every gun in the northwestern group of works comprising Fort Georg, Battery Mamula Robertson and Bentinck Towers and Battery Zupparina, except a 30-pdr. coast howitzer in the battery at the foot of Bentinck, and three 24-pdr. breech-loaders at Zupparina, and were entitled to expect that, if their ironclads could destroy Battery Madonna at the head of the harbor, and if the troops could be disembarked at Karober and could attack the defences of St. Giorgio in the rear, the island would be won. While, therefore, the squadron redoubled its fire, and the flagship placed herself opposite Battery Zupparina and endeavored to crush it by repeated broadsides, the Formidabile, supported, but at a distance of two miles by Vacca's ships, the Principe Carignano, Castelfidardo and Ancona, made for the center of the bay.

87. The garrison hastily placed its reserve artillery (in the shape of a few guns from the more remote emplacements) as near as possible to the harbor, and the 10th Company of Marine Infantry lined the slope on each side of Battery Madonna, and occupied the rows of houses at Kut, immediately to the right, for the advancing vessels this time showed no hesitation, but a full determination to succeed.

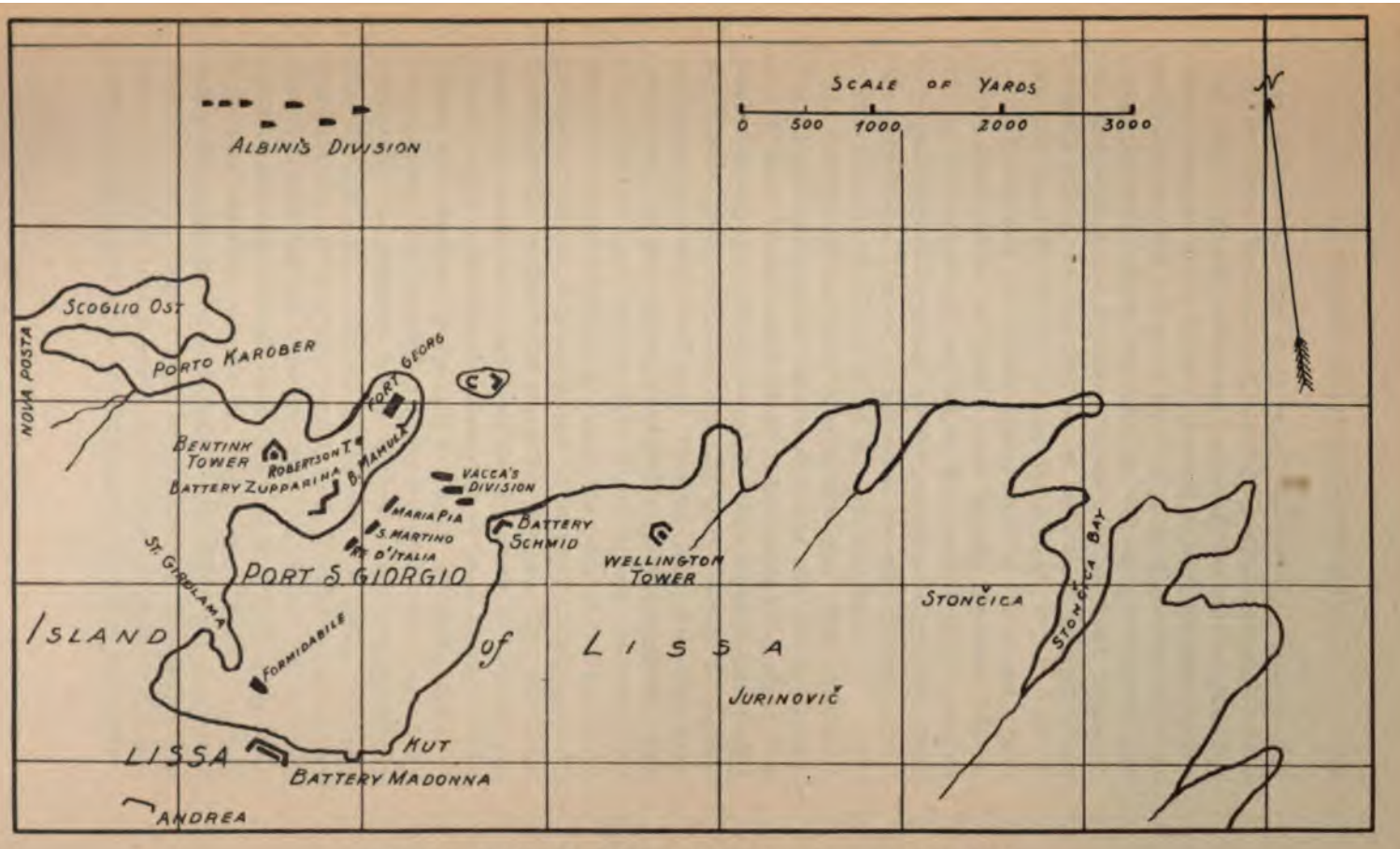
88. At their head came the Formidabile, which, flinging a few shots at Zupparina, brought up at a distance of about three cables from Madonna and turned her broadside against that battery. In vain did Zupparina endeavor, as on the previous day,

to throw its shells through the ports of the ironclad, the rapid approach of which rendered such delicate shooting impossible. Bentinck could not bring a gun to bear; Wellington could fire only occasionally, and then had to exercise extreme caution, and Battery Madonna, with its eight guns on the open rampart, was left alone to maintain the unequal combat, for presently Zupparina was obliged exclusively to confine itself to returning the fire of the flagship. Madonna, nevertheless, steadily concentrated its fire on the Formidabile, which, like a wall, covered the three ships behind her, until they swung clear, whereupon they, too, began to ply the battery with broadside after broadside. The commander of the work, First Lieutenant Jauernig, of the Coast Artillery Regiment, behaved at this crisis with extraordinary coolness, and set a brilliant example of courage and energy.

89. The Austrian 30-pdr. shells did but little damage when they struck the sides of the ironclads; but several of them found open ports and carried death and destruction between decks. The field-guns on Cosmo and Andrea, and the infantry on the slopes and in Kut, cooperated to the best of their ability. A lucky shot from a La Hitte 6-pdr. on Cosmo set on fire one of the ships, and a shell from Madonna brought about a conflagration in another.

90. In the meantime the Formidabile carried out a brilliant and dangerous manœuvre. Dropping an anchor and letting the cable run out, she went slowly astern towards St. Girolamo, thereby not only providing more room for her consorts, but also threatening to take up a position whence she could enfilade Madonna. [See plan.] Yet scarcely had she begun this movement ere Vacca's three ships, the Principe Carignano, Castelfidardo and Ancona, turned round and drew off, followed by the shells from Madonna and Wellington.

91. The Formidabile was left alone, exposed to the guns of Madonna and Cosmo. She was obliged to stop firing, to close her ports, to steam up to her anchor, and then to slip her cable. Twice, as she was doing this, her colors were shot away, but on each occasion new ones were promptly run up. The whole Austrian garrison witnessed the behavior of the ironclad and could not repress its admiration. The Formidabile's gallant captain, Pacoret di Saint Bon, was Italian Minister of Marine



ITALIAN ATTACK ON PORT S. GIORGIO, LISSA, JULY 19, 1866.

from 1873 to 1876, and again from 1891 until his death in November, 1892. Not only at Lissa did he serve his country well.

92. After Vacca's withdrawal, Admiral Persano realized the critical situation of the Formidabile and ordered his own captain to tow her out; but before the Re d'Italia could execute the command, Captain di Saint Bon, with his rigging cut to pieces and with three killed and fifty-five wounded on his decks, managed to steam out of the bay, fired as he went from every Austrian gun that could be brought to bear upon him.

93. During this part of the action most of the enemy's projectiles struck below, or passed over, Battery Madonna. Twice the roof of the barracks was set on fire; but the flames were as often promptly extinguished by the garrison before they could make headway. The loss in the work was astonishingly small, for it consisted only of one killed and one wounded.

94. Fortune did not favor Admiral Persano. The withdrawal of the ironclads from the inner harbor was not of vital importance. Those vessels could hardly have decided the day. The great blow was to have been struck by Vice-Admiral Albini, who was to have landed with 2600 men, and to have taken the already well pounded works in the rear. Had that part of the plan been carried out, the garrison must inevitably have surrendered. But Albini did not carry out his part of the scheme. A craft with troops on board approached Punta Stupiski, at the mouth of the Bay of Comisa, but was driven off by the La Hitte guns on Monte Perlić; another craft made for Stončica Bay, but withdrew after some shells had been thrown at her by Wellington Tower, and a steam-launch, towing three boats towards Porto Chiave was repulsed by the 4th Company of Marine Infantry with rockets. The landing at Porto Karober was not seriously attempted, Vice-Admiral Albini informing his commander-in-chief that the state of the sea rendered it impossible. Persano described this as "singular," seeing that Karober opens to the northeast, and that the wind was from the south. He declared also that his ships, though more exposed, were perfectly steady. It is very difficult properly to characterize Albini's conduct during the whole period of the attack on Lissa. It is on record that there was much suggestive murmuring throughout the fleet. At 8 P. M. the Admiral again collected his fleet at a distance of about eight miles from the island and dropped anchor.

95. At nightfall all fighting had ceased at Lissa. Everywhere, save about Fort Georg, where the flagstaff had been shot away and could not be replaced, the Austrian flag still waved; but Fort Georg, Battery Mamula, and Robertson Tower had been effectually silenced. The scarp and counter-scarp of Fort Georg had been knocked to pieces; the glacis was a series of pits, and the roof of the reserve magazine had been several times pierced. The barracks had escaped serious damage, but the breastwork of the terrace on which the 18-pdrs. had been planted was completely razed. The open batteries had suffered most of all, and the carriages of every one of their guns were useless. Batteries Mamula and Zupparina had a few shell craters in the solid stonework of their scarps, but they would have received much worse damage had not several shells which struck near their magazines failed to burst. The hillside above Zupparina was ploughed up by the projectiles which, thrown from the direction of Novaposta, fell and burst there. A wooden building near the battery was burnt to the ground. Robertson Tower had received few projectiles. Bentinck Tower, and the scarp of the work at its base, were marked with numerous small craters. One shot struck the wall of the powder-magazine in the Tower, but did not penetrate it. The right face of Battery Schmid was a mere heap of earth and stones, but the left half of the work was comparatively uninjured, though the guns were upset and their carriages smashed. Nadpostranje had not been touched. The marks of a few shells near the foot of the glacis were the only evidences that the place had undergone bombardment.

96. The number of projectiles, apart from rockets, thrown by the defence during the two days was 2733.

97. The garrison was naturally much fatigued by its 36 hours' continuous exertions, for it had worked during the whole of the night of the 18th, not only in repairing the works, but also in bringing up munitions and stores, and in substituting fresh gun-carriages for those which had been damaged. By the evening of the 19th the only guns remaining fit for service were, in Zupparina one, in Bentinck two, in Wellington five, in Madonna seven, the artillery on Cosmo and in the interior of the island, and the rocket tubes. The losses of the garrison amounted to twenty-four men killed and two officers and sixty-eight men wounded. Of the casualties, thirty-five occurred in Battery

Schmid, twenty-four in Fort Georg, and twenty-one in Battery Mamula.

98. The Italian losses were as follows:

	On July 18th.		On July 19th.	
	Killed.	Wounded.	Killed.	Wounded.
Re di Portogallo	4	14	..	..
Maria Pia	1	6	..	..
San Martino	..	6	..	..
Formidabile	..	..	3	55
Ancona	..	..	6	17
Palestro	..	9	..	..
Varese	..	1	..	..
Maria Adelaide	2	5	..	..
Governolo	..	..	..	1
	7	41	9	73

making in all a loss of 16 killed and 114 wounded. Several of the ships had been damaged, and scarcely any of them had more than two days' coal remaining on board.

99. In view of the condition of his fleet, and of the possibility, which he himself at length unwillingly admitted, that the prolonged attack on Lissa would induce the Austrian squadron to come out, Admiral Persano found himself in considerable difficulty. Either, on the following day, and before the appearance of the Austrians, he must continue the struggle, and, by means of a vigorous attack by sea and land, secure the fall of the place, or he must suspend his half-accomplished purpose, return to Ancona, fill up with coal and stores, and then act as circumstances might suggest. That night he decided in favor of the former alternative, and ordered Captain di Monale to disembark the troops on the morning of the 20th as soon as the first guns should be fired by the ironclads. But the morning was a dirty one, and it seemed a question whether the landing could be effected. Deputy Boggio,* of the Italian Parliament, who was the Admiral's guest in the flagship, and who was always urging Persano to activity, recommended the disembarkation, but Captain d'Amico, chief of the general staff, was opposed to it, and

* This gentleman's position and actions recall in some degree those of Jean Bon Saint-André in the flagship of M. Villaret-Joyeuse in 1794.

Rear-Admiral Vacca, who visited the flagship, also favored the abandonment of the undertaking and the return to Ancona. Admiral Persano would probably have followed this course had not a chance event occurred to sway his weak mind in the other direction.

100. Soon after sunrise on the 20th, the hired paddle-vessel Piemonte, with a battalion of marine infantry on board, joined the fleet. This decided Persano to continue the attack on Lissa, and he at once ordered Vice-Admiral Albini to proceed with the disembarkation at Karober. The ironclads Terribile and Varese were again to grapple with the batteries in the bay of Comisa, and the commander-in-chief himself, with the other ironclads, was once more to bombard the works in Port St. Giorgio.

101. At 8 A. M., Albini's division, with the gunboat flotilla, was busy off Porto Karober with preparations for the landing; the Terribile and Varese were getting ready to attack Comisa; the other ironclads, off the mouth of Port St. Giorgio, were awaiting the signal to move in and renew the bombardment; the Formidabile was transhipping her wounded to the Washington, and the Re di Portogallo and Castelfidardo had just intimated that their machinery was temporarily out of order, when suddenly the Esploratore (see §56) steamed in fast from Punta Planca, flying the signal—"Suspicious ships in sight."

V. The Battle of Lissa.

102. Admiral Persano, thus, as it were, caught with his boots off, could not for an instant be in doubt that the Austrian fleet was upon him. He made hurried preparations to meet it, though it would appear that, up to that instant, he had never formed any clear conception of how he would endeavor to do so. His long-standing and at length gratified anxiety to have the Affondatore with him, and his untimely transfer of his flag to her, indicate that he had an exaggerated idea of the value of the ram in action. The same is suggested by his first movements after learning of the Austrian approach. His later movements, nevertheless, seem to show that he went into action trusting mainly to the gun. These, I think, were right tactics for an officer with vastly superior gun-fire at his command, as Persano had; but one cannot feel sure that he acted in pursuance of any settled plan, principle, or conviction.

103. As he assumed the enemy to be following in the wake of the Esploratore, Persano ordered his whole fleet to form in line abreast towards the W. N. W.; but presently, when he made out rising smoke in the N. N. E., he changed his front so as to face in that direction. Vice-Admiral Albini was signalled not to proceed with the disembarkation, and later, when it was seen from the flagship that the Italian wooden vessels were not in motion, Persano, with the intention of hurrying them, made: "The enemy is in sight." In the meantime he ordered the corvettes Governolo and Guiscardo to tow the two ironclads which had intimated that their machinery was out of order; despatched the Messaggiere to recall the Terribile and Varese from before Comisa, and with the greater part of his force, steamed in the direction of the foe.

104. That morning the island was shrouded in a thick mist. On shore, therefore, the movements of the Italians were misapprehended, and nothing was known of the coming succor. But at about 10 A. M. the sun burst through, and the garrison, which had expected to be called upon to make a last desperate struggle, saw instead the welcome spectacle of the Italian ships hurriedly assembling on the north side of the island, and of the Austrian fleet in close and imposing formation approaching from the northeast. The sight drew a cheer from the weary defenders of Lissa, who then, in spellbound silence, awaited the playing out before their eyes of the bloody drama in which their persecutors and their saviours were about to take part.

105. The Austrian fleet, twenty-seven* pennants strong, had been under way, in company, since 1.30 on the afternoon of July 19 (see §21). At 2.30 P. M. it passed the lighthouse of Promontore, and then headed to the southeast on a direct course for Lissa. It was formed into three divisions as follows:

I.	II.	III.
Rear-Admiral v. Tegetthoff.	Commod. v. Petz.	Command. v. Eberle.
To Starboard:		
Don Juan de Austria,	G. Radetzky,	Velebich,
Drache,	Donau,	Wall,
Prinz Eugen,	Novara,	Streiter,

* The Stadium, from Pola, did not take up her station till 5 p. m.

Leaders:		
E. H. Ferdinand Max,	Kaiser,	Hum,
To Port:		
Habsburg,	E. H. Friedrich,	Seehund,
Salamander,	Adria,	Dalmat,
Kaiser Max,	F. Schwarzenberg,	Reka,
K. Elisabeth,	Greif,	Narenta,
	Stadium,	Kerka,
		And. Hofer.

The order of each division was what Professor Laughton has called "a double oblique line." This expression does not very well explain it. The order, to describe it more exactly, was, so far as each division was concerned, one of column disposed quarterly to port and starboard, the senior officer's ship occupying in each case the central station or point of the wedge. The second division followed the first, and the third the second. The official Austrian description, literally translated, gave the order of the fleet as "separate divisions formed in salient angle and following in wake." This was the cruising as well as the attacking formation. The description, whatever it be, applies, however, only to the first seven ships of each division. Up to the delivery of the attack, the Stadium proceeded the Erzherzog Ferdinand Max at the head of the entire fleet; the Kaiserin Elisabeth followed astern of the Erzherzog Ferdinand Max; the Greif followed astern of the Kaiser, and the Andreas Hofer, with Narenta on her starboard, and the Kerka on her port bow, followed astern of the Hum. The small craft were thus disposed, chiefly in order to repeat signals. The above, as has been said, was the steaming as well as the fighting formation; but the instructions were to the effect that, upon the actual shock of battle taking place, the second division might be utilized according to the judgment of Commodore von Petz, and that the third division, broken up into three divisions, should remain in the neighborhood of the mêlée, and hold itself in readiness to support or succor the heavy wooden ships.

106. Towards evening on the 19th, the sea got up somewhat under the influence of a southeasterly breeze, and as some of the ships experienced difficulty in keeping station, the speed of

the fleet was reduced to five and a half knots. A little later the commander-in-chief had a conference with his flag-captain, and the officers of his staff, upon the events of the coming day, and discussed the possibility that the fleet might find the Italians already in possession of the harbor of St. Giorgio. It was decided that, in that event, as also in the event of an encounter with the enemy at sea, the ironclads should dash in and endeavor to ram, and that it should be their aim to pour into concentrated broadsides at the shortest possible range. My historical conclusions as to the tactics of the ram will be found in Whole No. 69 of these PROCEEDINGS. Of 74 recorded cases on which I based those conclusions, 48 were, or may have been, known to von Tegetthoff. He certainly overrated the powers of his weapon. At least, however, he knew what his intentions were, and he stuck to them. Moreover, it must be recollected that he was well aware of his inferiority in gun-power. He had already practiced his people in the firing of concentrated broadsides. At the same conference it was wisely decided that, should the Admiral fall in the action, intimation of the event to the fleet should be deferred until a fitting opportunity, and that, in the interval, the flagship should continue to lead, without reference to the seniority of her captain.

107. Towards morning on the 20th the sky became so threatening, and wind and sea increased so much, that the smaller ironclads, the batteries of which were close to the water, were obliged to close their ports. At 7 A. M. the Kaiser Max, which, with the Prinz Eugen and the Stadium, had been temporarily detached ahead to scout, reported "Six steamers in sight," and the flagship almost simultaneously discovered smoke to the southeast; but immediately afterwards a squall of rain came down and prevented further observation. Nothing much more inconvenient could have happened at that juncture; but von Tegetthoff did not hesitate, and pressed steadily onwards towards his goal. At about 9 A. M. the weather began to clear again; the wind went round to the northwest and the sea moderated, although it still kept wet the battery-decks of the smaller ironclads, and remained rough enough to render great caution necessary in working the guns on board all the small craft during the battle which followed. When, at 10 A. M., the mist disappeared, the Austrians saw the enemy right ahead, assembling off the north coast of Lissa.

108. In quick succession the following signals were made by Rear-Admiral von Tegetthoff:

"Clear for action."

"Close order."

"Scouts to their stations."

"Proceed at full speed,"

and, at 10.35, came the historic signal of the day:—

"Ironclads will dash at the enemy and sink him."*

Yet another signal—"This must be the Victory of Lissa"†—had been prepared, but, in consequence of the rapid closing of the two fleets, could not be made. Each signal that went up was greeted with cheers.

109. Every preparation was quickly concluded, and steering south-southeast, the imperial fleet steamed hard for the Italian ironclads which, hastily collected, and disposed in column of single line ahead, were approaching on a north-northeast course.

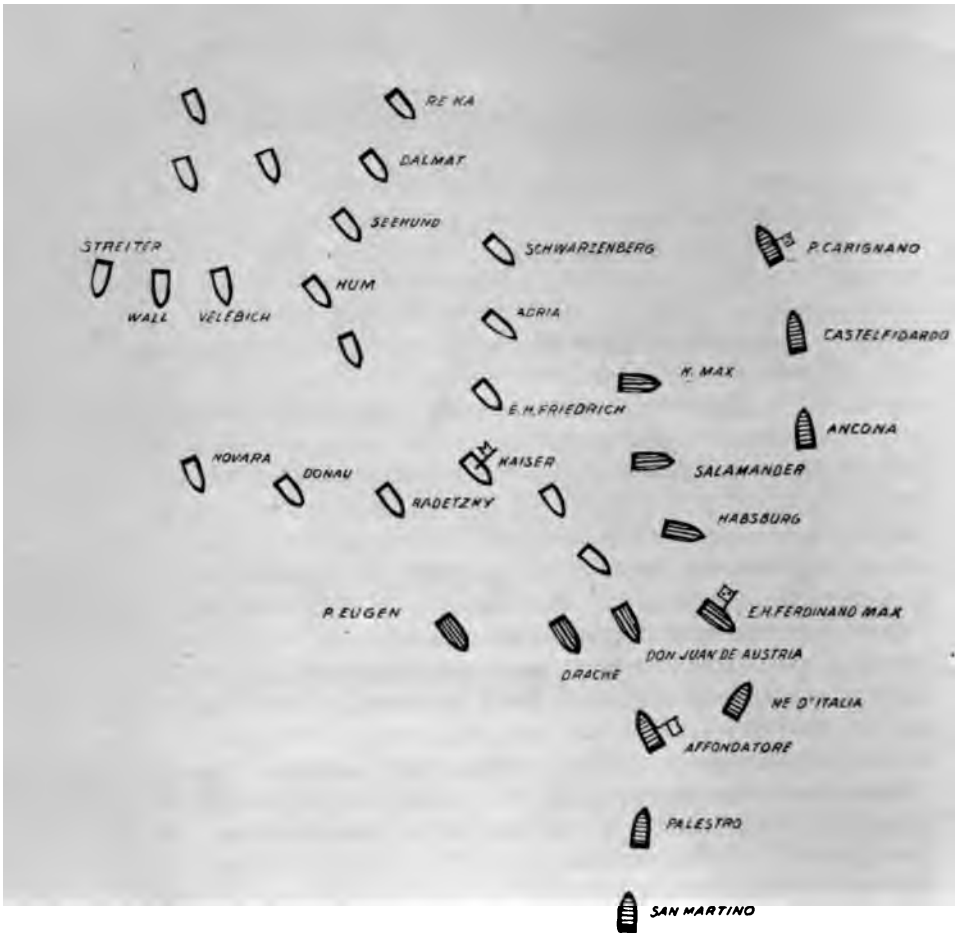
110. The line was led by Rear-Admiral Vacca in the Principe di Carignano, followed by the Castelfidardo and Ancona. Then came Admiral Persano in the Re d'Italia, followed by the Palestro and San Martino, with the Re di Portogallo, Maria Pia and Varese further astern. The Affondatore was somewhere on the starboard beam of the column. The Formidabile, no longer fit for fighting, was making for Ancona, and the Terribile was on her way from Comisa, and ultimately attached herself to the squadron of wooden ships, which gradually assembled off Travna Bay, and took no part in the action.

111. Such was the general situation when Admiral Persano thought it desirable to shift his flag from the Re d'Italia to the Affondatore, and to take his personal staff with him. To enable him to do so, the Re d'Italia was stopped, and the distance, five or six cables, that originally intervened between her and the ships of Rear-Admiral Vacca's division, was thus greatly increased; for Vacca, who had not been warned, pursued his course. The admiral passed from one ship to the other in a launch, which, strange to say, was then turned adrift and afterwards picked up by the Governolo. While Persano was shifting his flag, the Principe di Carignano, at 10.43 A. M., opened fire at a

* "Panzerschiffe den Feind anrennen und zum Sinken bringen."

† "Muss Sieg von Lissa werden."

LISSA, JULY 20, 1866.
THE AUSTRIAN ATTACK.



LISSA, JULY 20, 1866. THE FIRST SHOCK.

distance of some cables upon the advancing Austrians, and her example was presently followed by all the other Italian ships. One of the first projectiles to be discharged killed Heinrich, Freiherr von Moll, captain of the Drache, but the ship was promptly taken in charge by Linienschiffs Fähnrich Weiprecht* until Lieutenant Matthieu could be summoned to assume the duty. What possessed Persano to change his flagship at the last moment, in such haste, and without notifying the fact by signal to his fleet, has never been fully explained. He was, however, notoriously a great believer in the offensive and defensive powers of the ram Affondatore. Probably his besetting infirmity of purpose had prevented him from making up his mind at an earlier moment. The ship at that time had a speed of about 11 knots, but was very unhandy, and occupied 8½ minutes in turning a complete circle.

112. The Austrian first division, which had a little thrown forward its port ships, returned the fire but continued its advance. Dense smoke presently enveloped both fleets, the consequence being that several Austrian ironclads, including the flagship, were unable to see the position of the Italian vessels, and passed through the wide gap between the Ancona and the Re d'Italia, thus unwittingly cutting off the head of the Italian column. As soon as this became evident, most of the vessels on the port quarter of the Ferdinand Max kept away to port to occupy the attention of Rear-Admiral Vacca, while those on her starboard quarter kept away to starboard to engage the rest of the Italian column as it came up. The Ferdinand Max herself having passed through the line, turned round to port and made for the central hostile group, which, in the meantime, had also swerved a little to port as if with the intention of falling upon the second Austrian division—the division of heavy wooden ships. Perceiving this intention, the Austrian ironclads on the original right turned somewhat again to protect the second division, which, with great gallantry, made for the rear portion of the Italian line. Thereupon ensued a regular mêlée, which, from moment to moment, increased, both in complication and in magnitude, and which it is impossible to describe in detail. From that time until the end of the engagement, each ship manœuvred independently,

* Afterwards commander of the Arctic discovery ship Tegetthoff.

striving to ram, to escape the ram, or to interpose for the protection of a threatened consort. Vessels passed one another continually within pistol shot, emerging from one bank of obscurity to enter another, and often having barely time to discharge their concentrated broadsides into an enemy of whom they caught but vague and fleeting glimpses. The national ensigns were not distinguishable amid the rolling volumes of steam and smoke of powder and coal, and it was fortunate for both sides that all the Austrian ships were painted black, and all the Italian gray. Von Tegetthoff's plans were of so simple and elementary a character, and they left so much to each captain's discretion after the first shock of action, that the Austrian commander-in-chief deliberately refrained from making any signals after the battle had begun. The smoke would have prevented signals from being taken in had he made them. But a modern engagement, fought with smokeless powder, may be, and, I think, should be, controlled from first to last from the flagships. There ought to be no mêlée in future. The work of each ship ought to be part of the general tactical scheme. All that can be said as to the conduct of the action was that, broadly and with some exceptions, most of the Austrian wooden ships, having turned a little to starboard, were engaged with the ironclads of the Italian rear; that the right wing and center of the Austrian ironclad division were engaged with the ironclads of the Italian center, and that the left wing of the Austrian ironclad division, and the rear of the Austrian wooden ships, were engaged with the Italian van, which, under Vacca, had circled round to port.

113. In the meantime, Persano, in the Affondatore, found his way between the Re d'Italia and the Palestro, and appeared in the immediate rear of the first Austrian division, making repeated and vain attempts to ram now one ship and now another, and then working round to the southward.

114. Commodore von Petz, of the second Austrian division, narrowly escaped the Affondatore. Seeing that the Italian wooden ships were lying off Lissa, the Commodore had made up his mind to get at them if possible, and, with that object, had turned to starboard, and formed the vessels of his division into something like line astern of him. Captain Ribotti who, in the Re di Portogallo, commanded the Italian rear, had been at first inclined to proceed to the assistance of the Italian center, but

awaking to the Commodore's design, had turned to port, hoping to cut him off in such a manner as to leave him at the mercy of Vice-Admiral Albini's wooden division which was apparently coming out. Von Petz, on his part, had turned to meet Ribotti's division, and had brought his seven ships, as well as the Kaiserin Elisabeth, into action with the Re di Portogallo, Maria Pia, Varese and San Martino, this last having for a time delayed her progress. Such was the position of affairs in the southern part of the scene of action, when the Affondatore suddenly rushed out of the smoke on the Kaiser's starboard beam, and endeavored to ram the wooden line-of-battle ship. Twice she charged, each time firing several 300-pdr. projectiles, one of which wrought great damage, dismounting an upper deck gun, putting out of action six men at the Kaiser's wheel, and smashing engine-room telegraph, binnacle, and much else. But the Kaiser was able, while eluding the shocks, to deliver a couple of concentrated broadsides, which did much damage to the Affondatore's top-hamper and deck, and induced the ram to sheer off. After the second attempt at ramming the two vessels scraped alongside one another, exchanging small-arm fire, which killed Linienschiffs Fähnrich Robert Proch, who fell from one of the Kaiser's tops to the deck.

115. Scarcely was the wooden line-of-battle ship free from her formidable opponent ere she was threatened by the Italian iron-clad Re di Portogallo, which, with the Maria Pia and Varese, had brought a heavy fire to bear upon the leading ships of the Austrian wooden division. Many of their projectiles flew over the Kaiser and struck the Novara, disposed to starboard, and the Erzherzog Friedrich and Kaiserin Elisabeth, disposed on the port quarter, of the two-decker. One killed Captain Erik of Klint, whose place, as commander of the Novara, was taken by Lieutenant Schröder; another struck the Erzherzog Friedrich below the water-line, causing her to make nineteen inches of water an hour. This, however, was kept in check by the steam-pumps.

116. So dense was the smoke that the Kaiser did not see the Re di Portogallo until the latter was quite close, and was approaching at full speed with the obvious intention of ramming. The two-decker could have escaped the blow by making a quick movement of her helm, but had she done so she would have

exposed to immediate destruction the Kaiserin Elisabeth and Erzherzog Friedrich, which were at barely a cable's distance. Trusting, therefore, to the weight and structural strength of his ship, Commodore von Petz decided to attack his armored foe. Turning first a little to starboard, and then hard to port, he placed his enemy's broadside fairly in front of him and rammed at full speed, striking the Re di Portogallo on the beam abreast of the machinery. In was exactly 11 o'clock, 17 minutes after the firing of the first shot by the Italians.

117. Captain Ribotti, conscious of what was intended, turned to port just before the moment of impact and so weakened the force of the blow. Ribotti subsequently admitted that had he not done this, he would have been sunk. The effects of the shock, of the scraping passage along the ironclad's port side, and of the Italian broadside, discharged at close quarters, were terrible for the Kaiser. The bowsprit and entire stem of the two-decker were torn out of her in such a way that presently the foremast toppled over, carrying away with it the funnel and the imperial crown from the Kaiser's figure-head was left on the Re di Portogallo's deck. Nor did the ironclad escape scot-free. She lost two anchors, and several boats; of four field-guns which stood on her quarter-deck, one was knocked overboard; eleven of her port lids were smashed, and her side-armor, over a length of more than sixty feet, was displaced. In spite of her misfortunes, the Kaiser, as the Re di Portogallo swung round to starboard after the collision, managed to pour in a heavy fire from the forward guns of her main battery, discharged at short range. Several of the shot struck the ironclad below her armor, and a 24-pdr. shell from a rifled gun burst on her deck. This was followed up by repeated broadsides, and very soon the Re di Portogallo disappeared in the smoke. The two-decker was not yet, however, at the end of her adventures. Suddenly, at a distance of four cables, another ironclad, probably the Maria Pia, loomed up. Although the wreckage that overlay her funnel had by that time caught fire, the Kaiser at once began again to engage. Two Italian shells burst between decks and put part of her battery out of action; a steam-pipe was shot through; the quarter-deck was almost swept clean; and the officer in command of the quarter-deck quarters, Linienschiffs-Fähnrich Hugo Pogatschnigg, was badly hit. Nor was this all. The port side of the ship

was on fire, and the chief engineer sent up word that the machinery could no longer be trusted, and that, owing to the condition of the funnel, he could provide but very little steam. In the meantime the fire over the wreck of the funnel grew more serious; the steering-gear was damaged by a shot; the forward batteries were no longer able to take much share in the action; and the ship was, in short, so severely mauled that her captain at length came to the conclusion that he must endeavor to withdraw her out of gunshot. He therefore headed her for Port St. Giorgio; and he was followed thither by most of the large wooden ships and by some of the gun-vessels which had previously afforded all possible support to the two-decker, and had attracted to themselves a good many attentions from the hostile ironclads.

118. Several of these wooden craft were much damaged. The Schwarzenberg had received seven shots in her rigging, besides one in her foremast and one below the water-line, and leaked so badly that all her pumps had to be kept at work. The Adria had suffered grave injuries to her rigging and boats; had had her ensign shot away; had been thrice set on fire, and had four men badly and two men slightly wounded. Two dockyard laborers who were on board, and who were endeavoring to stop a hole which an 80-pdr. shell had occasioned near the water-line, were struck by a second shell and blown to pieces, and the burning fragments caused by the explosion scattered themselves in the neighborhood of the entrance to the magazine in such a manner that only by the coolness of the chief gunner, who promptly opened all the valves, was a terrible disaster averted. As for the Novara, besides her captain, she lost six killed and twenty wounded.

119. While the rear of the Italian line had thus unexpectedly been held in check by the Austrian wooden vessels, the two leading ironclads under Rear-Admiral Vacca, after Tegetthoff had broken through, had pursued their course, turning, however, somewhat to port, and so removing themselves from the Italian center, which, thus in a measure isolated, was assailed by the main strength of the Austrian ironclad division, and found itself in a critical position.

120. Tegetthoff's flagship, the Erzherzog Ferdinand Max, had tried to ram two hostile ironclads, but had struck them at so sharp an angle as to produce no effect of importance. Upon the

second occasion, however, the blow, delivered on the starboard quarter, brought down the enemy's mizzen topmast and gaff, the latter, with a gigantic tricolor attached to it, falling on the flagship's forecastle. Carcovich, a quartermaster, ran forward, and, after one ineffectual attempt, tore or cut the flag clear, and under a heavy small-arm fire, made it fast to a stanchion, where it remained.

121. Since, according to the Italian reports, no vessel that survived the day was rammed save the Re di Portogallo, it must be concluded that the two ships which were rammed were the Re d'Italia and the Palestro. That it was the Palestro which thus lost her flag to the Erzherzog Ferdinand Max is rendered the more probable by the fact that the gunboat Reka afterwards saw the Palestro when on fire, and noticed that she had no ensign at her peak.

122. The Re d'Italia, the leading ship of the Italian center, being supposed to be still Persano's flagship, was a natural object of general attack, and, immediately after Tegetthoff had broken the line, was surrounded by four Austrian ironclads, among which was the Erzherzog Ferdinand Max. The Palestro endeavored to proceed to the assistance of the sorely pressed vessel; but two Austrian ironclads opened a heavy fire upon her and barred her way. The Palestro's iron sides effectively resisted the Austrian shot, and little harm had been done to the ship by the collision with the flagship of Tegetthoff. A shell, however, passed through her unarmored stern, and burst in the wardroom close to the magazine. It at once created a conflagration, and obliged the Palestro to go about to port in order to get out of action, and to have leisure to repress the flames. In the meantime the steering-gear of the Re d'Italia seems to have been damaged, for the vessel lay isolated in the midst of several Austrian ironclads and did not manœuvre. The Palestro went away to the northwards, and the San Martino withdrew towards the southwest, followed apparently by the Don Juan de Austria, and later by the Kaiser Max. It was then that the most dreadful and dramatic episode of the battle took place.

123. Rear-Admiral von Tegetthoff, gazing down from the bridge, where he stood surrounded by his staff, and betrayed a coolness to which even Italian writers have paid chivalrous tribute, could not but note the condition of the Re d'Italia. That

unfortunate ship, no longer obeying her helm, could only move straight ahead or straight astern. She was firing both broadsides; she had crowds of men ready on deck to board any opponent who might give her the opportunity; she was fighting with the courage of desperation.

124. Captain Freiherr von Sterneck, of the Erzherzog Ferdinand Max, fought his ship from half-way up the mizzen shrouds,* and ordered her to be headed at full speed for the port side of the Re d'Italia. When about two-thirds of a cable from her he ordered his engines to be stopped. The Re d'Italia made every possible endeavor to go ahead, so as to avoid or at least diminish the effect of the shock; but an Austrian ironclad barred the way. Instead of trying to ram the enemy ahead of her, the Re d'Italia attempted to go at full speed astern, but at the very moment when the ship had ceased to forge ahead and had not begun to feel the effect of the reversed screw, and when, in consequence, she was practically stationary, she was struck full amidships by the Austrian flagship, which flung at her a weight of about 5000 tons at a speed of eleven and a half knots. The blow was dealt over the engine-room. Armor, backing, frames, beams and planking all crumpled inwards before that mighty thrust. The hole that was made was estimated to have an opening 300 square feet in extent, half of it being below the waterline. Below decks in the Erzherzog Ferdinand Max, where no one expected the shock, the people were thrown violently forward. The chief engineer, in pursuit of previous instructions, immediately reversed his engines, and withdrawing the fatal ram, which had penetrated to a depth of six and a half feet, freed the flagship from her mortally injured enemy.

125. The Re d'Italia, under the force of the blow, heeled over slowly about twenty-five degrees to starboard, swung back rather suddenly to port, plunging her huge wound into the waves and then almost instantly sank. For the victors it was a sublime yet shocking moment, when the enemy's deck, crowded with human beings who cheered and fired to the last, tilted up, till men, guns, boats and gear slid down in struggling confusion, and when a brave and splendid ship disappeared forever in 200 fathoms of water.

* Compare Farragut at Mobile Bay.

126. As the ship sank, some of her people were observed to hurry aft as if to haul down her ensign, but two gallant officers, Signors Razetti and Del Santo, forcibly prevented them, and the ship went to the bottom with the Italian flag still flying. This was at 11.20 A. M., only thirty-seven minutes after the action had begun.

127. Upon the turbulent water where the Re d'Italia had floated there were only some fragments of wreck and a few struggling survivors, who, having jumped clear of the vessel, had not been sucked down with her. For some seconds the victors looked in awed silence at the scene. Then a tumultuous hurrah went up from every Austrian ship within sight.

128. The collision had bent in the plates on the Ferdinand Max's bows, and, sheering off the heads of a few rivets, had given rise to a slight leak. But in no other respect was the Austrian flagship injured. Von Tegetthoff's first care was to save his late enemies, some of whom clung to spars and floating débris, while others supported themselves by swimming. One of the starboard boats, the only one which would float, was ordered to be lowered, but ere she could be put into the water an Italian ironclad, clearly intent upon ramming, appeared upon the flagship's port quarter. The enemy was probably the Ancona. Freiherr von Sterneck, with great composure avoided the blow, but the two ships passed one another so closely that the people in the Ferdinand Max's port battery were unable to get the rammers into the muzzles of their guns. The enemy fired several rounds, the smoke of which entered the Ferdinand Max's ports, but there were no signs of any projectiles, and it was supposed that the guns were not shotted. The captain of the Ancona in his report practically admitted that they were not, and ascribed the omission to the fact that his guns used sometimes iron and sometimes steel projectiles. As the choice of projectiles, in view of the work to be done, would be naturally delayed until the last minute, it is possible that, in the excitement of action, the projectile was altogether forgotten, the guns being, of course, muzzle-loaders, and the powder being put in first. It has been alleged, moreover, that after the action some Italian guns were found to have been loaded with the powder on top of the shot. No doubt many of the guns' crews lost their heads completely.

129. The Ferdinand Max and the Ancona separated without further hostile action. Other Austrian ships, in addition to the flagship, made repeated efforts to pick up the survivors of the Re d'Italia, but were as often attacked and obliged to consult their own safety. The Kaiserin Elisabeth, for example, which was close to the flagship, and to the northward of the Re d'Italia at the moment when the latter foundered, did her best; but an Italian ironclad got across her stern, and, firing briskly, caused her some loss, and drove her off. The screw schooners, Kerka and Narenta, which, owing to their bad speed, were, at the opening of the action, six cables behind their division, but which followed into the fray, also approached the scene of the catastrophe, but while they were about to render help, they found themselves within range of two hostile ironclads, one of which was the burning Palestro, and were forced to withdraw.

130. Meanwhile the Ancona headed for the Re di Portogallo, which was much pressed by several Austrian ships, and on the way she came into accidental collision with the Varese, which not only had been the last of her division, but also had remained somewhat astern of station, and was now likewise pressing on to succor the Re di Portogallo. The Varese had an armor-plate dislodged, and both ships suffered some damage. Moreover, their rigging became so entangled that an appreciable time elapsed ere they could get free again. The Re di Portogallo, soon after her encounter with the Kaiser, had turned to port to clear the Austrian wooden ships, and then to starboard to escape two hostile ironclads, and, separated for a period from the ships of her division, had the very greatest difficulty in avoiding her opponents. While, nevertheless, she was engaged in repairing damages, and was still in a most precarious situation, she made an effort to ram an Austrian wooden frigate, and so to make a way of escape for herself. Captain Ribotti believed this frigate to be the Novara, but she was undoubtedly the Schwarzenberg, which received the Re di Portogallo with a concentrated broadside, and wrought fresh injuries both to the masts and to the hull of the ironclad. At last, however, Ribotti freed himself, and joined Rear-Admiral Vacca, who had just previously made the signal: "Form column of line ahead, without reference to the order of the ships."

131. The Maria Pia, which also belonged to the rear or

Ribotti's division, and which, like the Varese, had desired to succor the Re di Portogallo, had been obliged to describe a wide circle in order to afford sea-room to the entangled Ancona and Varese, and had thereby lost so much time that her help became unnecessary. She then attempted to bar the way to two Austrian ironclads which appeared to be making for the Italian wooden division, but she was attacked by two other Austrian ships. She tried to ram one of these, which crossed her bows, but the Austrian turned quickly to starboard, receiving, however, a full broadside and a volley of musketry from the Italian as the latter swept past. The Maria Pia thereupon headed for her ironclad consorts. These were little by little withdrawing to the westward out of action. It was probably at that time that the Maria Pia and San Martino collided. The latter received some damage forward—twisted her ram, bent or displaced several of her armor-plates, and sprang a slight leak. The former lost one armor-plate. This was the final episode of the action, and at 12.10 P. M. Rear-Admiral von Tegetthoff signalled to his fleet to close upon the flagship.

132. At the beginning of the action the two leading ships, the Principe di Carignano and the Castelfidardo, of the van or Vacca's division, exchanged a few shots as they passed with the Kaiser Max, Habsburg and Salamander. In the last-named, a projectile, one of the first, struck the conning-tower, and the splinters entering, wounded the captain, the signal-cadet and the signal-quartermaster, and smashed the conning-tower binnacle. Another projectile shattered the mizzen top and did further damage. In the course of the action, and towards the conclusion of it, the Italian van placed itself in the rear of the Austrian wooden vessels. With the object of breaking through these and joining Faa di Bruno's and Ribotti's divisions, the Carignano and Castelfidardo altered course to the southward; but the well-directed fire of the closely grouped ships of the Austrian rear kept the foe in check, and not only prevented him from venturing to ram any of the wooden craft, but also rendered him unable to do more than make an ill-directed return. In this long-range action the Austrian wooden frigates Donau, Radetzky and Schwarzenberg took part with their pivot-guns, and were well supported by several ships of the third or gunboat division, although the latter, owing to the tumbling sea, found it exceed-

ingly difficult to use their guns, some of which jumped from their mountings, or broke from their racers, and took charge. Among these craft were the gunboats Hum, Wall and Streiter, and the paddle-vessel Andreas Hofer, which last had attached herself to the second division, and kept in its wake. The Reka and Seehund had got up nearly with the leaders of the wooden division, while the Dalmat and Velebich had dropped somewhat astern of it.

133. While the Austrian ironclads were closing on the flagship, great part of the wooden squadron was already on its way to Port St. Giorgio. The two-decker, Kaiser, which, as has been related, had, owing to the damage inflicted upon her, been obliged to retire from action, was accompanied out of gunshot by the Erzherzog Friedrich, the Seehund and the Reka. Next came the frigates Schwarzenberg, Radetzky, Adria and Donau, and the gunboats Hum, Wall and Streiter, and astern of them the little Andreas Hofer. On her way the Kaiser did all that lay in her power to extinguish the fire which was still raging in her, and she was thus engaged when suddenly, on her starboard side, there appeared the Affondatore, which, after the vain attempt upon the two-decker, had described a big circle to port, repaired damage as well as possible, and steering along the north coast of the island, now threatened to bar the Kaiser's progress. Thrice she seemed to start ahead with the intention of ramming the Kaiser, which, in spite of her injuries, as often turned at bay, and, from amid the smoke and flame which covered her, fired broadside after broadside and kept off the foe. She was, at this crisis, nobly supported by the wooden ships astern of her, and later by the ironclads Don Juan and Prinz Eugen, all of which threw a perfect hail of projectiles upon the Italian ram, undeterred by the approach of the Principe di Carignano, Castelfidardo, Re di Portogallo, Ancona and Varese, which, in response to Vacca's signal, kept up a distant and resultless fire. Upon the third occasion, the Affondatore, at high speed, steamed to within one cable of the Kaiser and then suddenly fell away to starboard. She still, however, for some time, followed up the two-decker, but at last, with a damaged anchor, several shot through her deck, and a fire in her lower hold, turned to join the Italian wooden ships. The Kaiser returned her last shot at a distance of ten cables.

134. According to Italian accounts, Persano had personally directed the commander of the Affondatore, Captain Martini, to ram the Kaiser, but when the ships were in close proximity, and only the order "starboard your helm" was needed to produce the fatal result, Persano gave the word "port your helm," and stuck to it in spite of the representations of those around him. Persano himself declared that, chancing at that moment to observe for the first time how terribly the two-decker had suffered, he had not deemed it proper to further concern himself with so helpless a foe.

135. At about the same time the Don Juan de Austria received from the Affondatore, which had unceasingly fired her 300-pdrs., a shot that struck an armor-plate between two ports, a second on the armor below the water-line, and a third that shattered the butt of the bowsprit.

136. The two-decker, freed from the presence of her dangerous enemy, continued her course, uninterfered with, and reached Port St. Giorgio at 1.15 P. M., anchoring across the harbor mouth. The gunboat Reka followed her in, but, seeing the Kaiser signal: "There is hope of mastering the fire," she remained for only half an hour. The remaining wooden ships which, after the departure of the Affondatore, considered that the Kaiser's peril was over, again headed to the northward, led by the Schwarzenberg, to rejoin the ironclad division. This (in consequence of Tegetthoff's signal made at 12.20 P. M.: "Follow in wake of the Admiral") met the northward steering squadron half-way, and the fleet being thus reassembled, the commander-in-chief as quickly as possible reformed it in three columns of divisions in line ahead disposed to starboard, the iron-clad division taking the post of honor next the enemy. The course steered was northeast. The new formation was such as permitted of the original wedge-like formation being quickly resumed in case of need. While it was being carried out several of the Italian wooden ships of Vice-Admiral Albini's division opened a lively, but distant and useless fire.

137. As soon as the Affondatore had withdrawn out of gunshot of the Austrian wooden ships, Admiral Persano hastened to that portion of his force which was still engaged in moving along the northwest coast of Lissa. His intention was to order it to continue the engagement. Vice-Admiral Albini declared that

thrice during the battle he had endeavored to approach the scene of action, but on each occasion had been prevented by Austrian ironclads. Of the Austrian ships a few, at about 11 o'clock, had noticed a forward movement of the Italian wooden vessels, which, however, had quickly retired again. The fact is, that the whole of this squadron (with the ironclad Terribile* which clung to it) and its 400 guns, remained idle spectators of the action from beginning to end, and, after the conclusion of the fight, did nothing but fire a few ineffective rounds at a great range. Albini's passive attitude cannot but have had influence upon the fortunes of the Italian fleet on that day, and is the less justifiable, seeing that the behavior of the Austrian wooden division, the almost worthless paddle-vessels of which took gallant part in the fight, invited him to fling aside hesitation, and should have spurred him to emulation. It must be admitted that Persano displayed little more ineptitude than some of his subordinates.

138. Persano was certainly very angry at the continued inactivity of his wooden division, and approached it at full speed with the signals flying: "Attacate il nemico appena a portata" ("Closer action"), and "Surround the enemy's rear," by which he meant those Austrian ironclads which had had the last engagement with the Maria Pia, and, having been detained by it, were still seeking to rejoin their consorts. Persano also signalled: "The fleet, with individual freedom of movement and manœuvre, will go in chase of the enemy," and, in the Affondatore, he led the way against the main body of Austrian wooden ships which had just then quitted the Kaiser in order to join the ironclads. Persano hoped, by a quick and dashing onset, to prevent the junction; but, once more his wooden division left him in the lurch, although the Principe Umberto showed a good example, and, steaming after the Admiral, opened a brisk fire. Of the Italian ironclads only the Re di Portogallo obeyed the signal.

139. Persano, supposing that his signal was not understood, steamed down the whole line of the fleet with it flying, but the golden moment had passed, for the Austrian squadron, complete save for the Kaiser and the Reka, had assembled, and, already formed in three columns, was steaming northeast.

* Her captain was afterwards tried for misconduct.

140. Rear-Admiral von Tegetthoff, who, while his ships were closing around him, saw the burning Palestro, at a distance of about three-quarters of a mile to the northwest, making in the direction of the Italian wooden squadron, had ordered the Kaiser Max, at 1 P. M., to cut her off. The flagship herself had also proceeded towards the enemy, and had been followed by other vessels. But the Palestro, whose engines were still in good order, was not to be caught, and had been presently taken in tow by the paddle corvette Governolo, which had been specially detached for the purpose by Albini. Escorted by the Indipendenza, she had closed her consorts, one or two of which, including the Affondatore, had meanwhile advanced to protect her.

141. The Italian fleet subsequently altered course more than once, but the general direction of its movement was to the west-northwest. A few rounds were fired by each side, but the range steadily increased. At one moment it appeared as if the Italians, headed by the flagship, would again advance to the attack. The motions which gave rise to this impression upon the minds of those in the Austrian fleet were probably occasioned by the inclination of a few Italian vessels to act upon Persano's signals: "Closer action," and "The Admiral reminds the fleet that the ship which is not in action is not in her station." But, ere long, even Persano was obliged to surrender all idea of renewing the engagement. He learnt of the sinking of the Re d'Italia; he saw the critical situation of the Palestro, and the San Martino apprised him by signal that, owing to the extent of her damages, she could not keep station. The Italians finally headed for the channel between Lissa and Busi, and hostilities thereupon ceased.

142. While, therefore, the Austrian fleet, in order of battle, and complete except as regards the Kaiser and the Reka, which were in Port St. Giorgio, occupied the scene of action, the Italian fleet retired to the westward of Lissa. To follow up the retreating foe was not within the province of Admiral von Tegetthoff. His inferiority in guns forbade him to enter upon a long range engagement, and the very unequal speed of his ships also prevented him from entertaining the idea. Moreover, the enemy still possessed so many intact fighting units that it would have been sheer temerity on the part of the Austrians to imperil the results which had been already gained.

143. Since everything pointed to the fact that the Italians were

as little disposed as he was to reopen the question on that day, Tegetthoff altered course to the southeast, and, at about 2 P. M., directed the gunboats to proceed ahead to Port St. Giorgio. The heavy wooden division followed them; then the ironclad division, and, last of all, the flagship, which reached the harbor shortly before sunset, and was greeted with hearty cheers from the assembled fleet. While the gunboats were still under way, a violent explosion was heard, and those who were looking in the direction of the Italian fleet, saw the Palestro go into the air.

144. The commander of that vessel, Commander Alfredo Capellini, who had been invited by the convoying craft, Governolo and Indipendenza, as well as by Rear-Admiral Vacca, to take advantage of the boats which were sent to him, and to place his ship's company beyond the reach of danger, considered it as a point of honor, in spite of the ever-increasing risk, not to quit the vessel, and determinedly refused the proffered assistance. "Those who wish to go, may go," he said; "for my part, I remain." Following the example of their chief, the entire ship's company stuck to the Palestro, only the sick and wounded being removed to the Governolo. Every man went to his post and worked with the greatest devotion to combat the fire. The powder-magazine was flooded, and danger from that quarter seemed no longer to be apprehended; but the conflagration reached a compartment where, during the action, a number of filled shells had been placed. A great blaze of flame shot out from the ports on each broadside; a deafening report followed; wreckage and mangled corpses flew high in the air, and in an instant all was swallowed up by the waves. It was 2.30 P. M. when, in sight of both fleets, this final act closed the tragedy of the day.

A statement of the losses on the Austrian side is given in the table below. To this it may be added that the officers killed were: Captain Heinrich, Freiherr von Moll, commanding the Drache; Captain Erik of Klint, commanding the Novara; and Ensign Robert Proch, of the Kaiser; and that the officers wounded were: Captains Anton von Petz (Kaiser) and Carl Kern (Salamander); Lieutenants Julius Steiskal, Hermann Freiherr von Spaun, Joseph Frank and Franz, Freiherr von Minutillo; Ensigns Anton Kloss, Ferdinand Gebhardt and Hugo Pogatschnigg; Naval Cadets Ignaz Mader, Eduard Hanslik, August Süss and Victor Sambucchi, and acting Naval Cadets Adolf Hlouschek and Stefan, Ritter von Doymi.

Habsburg and Prinz Eugen, and the gunboats Dalmat and Velebich, cruised for the night off the port. Next morning at 3.30 A. M., the whole fleet, including even the Kaiser, which had managed to repair her funnel overnight, had steam up, and was in a condition to proceed to sea; but at break of day the signal-station on Monte Hum reported that the enemy was no longer in sight, and that some smoke, which was at first visible to the west-northwest, at a great distance, soon altogether disappeared. The Italian fleet, indeed, after cruising on and off on the evening of the 20th, had quitted the waters of the island at 10.30 P. M. and made for Ancona, where it arrived on the morning of the 21st. On August 6, owing, it is said, to the damages which she had received in the action, the Affondatore sank during a storm there. The Italian gunboats had been despatched to Manfredonia, in tow of the Washington and the Guiscardo. At 2 P. M. on the 21st, the Austrian Lloyd steamer Venezia, from Zara, reached Lissa, bringing from the Emperor Franz Josef a telegram thanking the officers and men of the fleet and apprising von Tegetthoff of his promotion to the rank of Vice-Admiral. At once he hoisted his flag at the fore, amid general cheering. That evening the dead were buried, the badly wounded were sent off in the Venezia to Spalato and Zara, and the Kaiserin Elisabeth and Dalmat, which had been sent out to look for any Italians who might be still floating near the scene of action, returned bringing only boats and wreckage. At 8.30 P. M. the whole fleet, except the Narenta and the Kerka, which were left under the orders of the commandant of the island, weighed, took up the old wedge-like formation, and put to sea to the northwest. In the evening of the 22d it once more anchored in the roadstead of Fasana.

[A crushing defeat had not been inflicted, and there were no prizes to grace the triumph of the victor; but the remarkable results which, with inferior forces, had been attained, gave the Austrian navy a heritage of splendid tradition, and shed immortal glory on the name of Tegetthoff. The victorious Admiral did not, I think, display qualities of any exceptional brilliancy; for his attacking formation is never likely to be imitated; but he betrayed an intelligent grasp of the ruling principles of naval strategy and a consistent firmness and strength of character which cannot but have favorably influenced all who served under him.]

Class. I = Iron. W = Wood.	Name of Ship.	Commander. *I Capt.* = *Linienschiffs-Capitän.* *II Capt.* = *Fregatten-Capitän.* *III Capt.* = *Corvetten-Capitän.*		Tons.	Horse power (nominal).	Men.	Guns.						
							Total.	24 pounders.		60 pounders.	48 pounders.	30 pounders.	12 pounders.
								R. B. L.	Shell.	S. R. M.	S. B. M.	S. B. M.	R.
1st Division.	W. Ironclad Frigate	Ferdinand Max.	*I Capt.*	Max., *Freiherr* v. Sterneck, *R. Adm.* W. v. Tegetthoff.	5,130	800	489	18	..	..	18	..	..
	W. " "	Habsburg.	"	Carl Faber.	5,130	800	478	18	..	..	18	..	..
	W. " " ...	Kaiser Max.	"	Gustav, *Ritter* v. Gröller.	3,588	650	386	30	14	..	16	..	..
	W. " "	Prinz Eugen.	"	Alfred Barry.	3,538	650	386	30	14	..	16	..	..
	W. " "	Don Juan de Austria.	"	Anton, *Ritter* v. Wiplinger.	3,588	650	386	28	14	..	14	..	..
	W. " "	Drache.	"	Heinrich, *Freiherr* v. Moll.	3,065	500	343	26	16	..	10	..	..
	W. " "	Salamander.	"	Carl Kern.	3,065	500	343	26	16	..	10	..	..
	W. Paddle Aviso.....	Kaiserin Elisabeth.	*II Capt.*	Tobias Oesterreicher.	1,470	350	166	6	2	..	..	..	4
2nd Division.	W. Screw Battleship.....	Kaiser.	*I Capt.*	Anton v. Petz (*Commodore*).	5,194	800	904	92	2	..	..	90	..
	W. Screw Frigate...	Novara.	"	Erik of Klint.	2,497	500	538	51	3	4	..	44	..
	W. " "	Fürst Schwarzenberg.	"	Georg Millosich.	2,514	400	547	46	4	6	..	36	..
	W. " "	Graf Radetzky.	"	Josef v. Aurnhammer.	2,198	300	398	31	3	4	..	24	..
	W. " "	Adria.	*II Capt.*	Adolf Daufalik.	2,198	300	398	31	3	4	..	24	..
	W. " "	Donau.	"	Max. Pittner.	2,198	300	398	31	3	4	..	24	..
	W. Screw Corvette	Erzherzog Friedrich.	"	Marcus Florio.	1,474	230	294	22	2	4	..	16	..
	W. Paddle Aviso.....	Greif.	"	Carl Kronowetter.	1,260	300	102	2	..	..	..	..	2
	W. Lloyd Steamer	Stadium.	*Lieut.*	Victor, *Graf* Wimpffen.	1,400	360	33	..	..	..	..	..	..
3rd Division.	W. Screw Gunboat	Hum.	*II Capt.*	Ludwig Eberle (*senr. off.*).	869	230	139	4	2	..	2	..	..
	W. " "	Dalmat.	*III Capt.*	Wilhelm v. Wickede.	869	230	139	4	2	..	2	..	..
	" "	Wall.	"	Alex. *Graf* Kielmansegge.	852	230	139	4	2	..	2	..	..
	" "	Velebich.	"	Victor Herzfeld.	869	230	139	4	2	..	2	..	..
	" "	Reka.	"	Adolf Nölting.	852	230	139	4	2	..	2	..	..
	W. " "	Seehund.	*II Capt.*	Wilhelm Calafatti.	852	230	139	4	2	..	2	..	..
	" "	Streiter.	"	Rudolf Ungewitter.	852	230	139	4	2	..	2	..	..
	W. Screw Schooner.....	Narenta.	*Lieut.*	Franz Spindler.	501	90	100	6	2	..	..	4	..
	W. " "	Kerka.	"	Gustav Masotti.	501	90	100	6	2	..	..	4	..
	Paddle Aviso	Andreas Hofer.	*III Capt.*	Ulrich William Lund.	770	180	109	4	1	..	..	3	..
					57,344	10,360	7,871	532	115	26	116	269	6

Note.—The elongated shell for the 24 pdr. R. B. L. weighed 64 lbs.; the steel ball for the 48 pdr. S. B. M., 55 lbs.; the shell for the 60 pdr. gun, 47½ lbs.; the ball for the 30 pdr. S. B. M., 32¼ lbs., and the shell for the 30 pdr. S. B. M., 24¼ lbs.

Class. I = Iron. W = Wood.	Name of Ship.	Commander. *I Capt.* = *Capitano di vascello.* *II Capt.* = *Capitano di fregata.*	Tons.	Horse power (nominal).	Men.	Guns. Total.	10 inches. Armstrong steel R.	8 inches. Armstrong steel R.	7 inches. Hooped R.	7 inches. R.	8 inches. S. B. M.	9 inches. Howitzer.	7 inches. S. B. M.	4.7 inches. R.
W. Ironclad Frigate.....	Re d'Italia.	*I Capt.* *Conte* Faa di Bruno, Adm. Persano.	5,700	800	600	36	..	2	16	14	4	..	..	..
W. " "	Re di Portogallo.	" *Caval.* Ribotti.	5,700	800	550	28	2	..	12	14	..	..	..	..
I. " "	Ancona.	" " Piola.	4,250	700	484	27	..	..	22	1	4	..	..	..
I. " "	Maria Pia.	" *Marchese* del Carretto.	4,250	700	484	26	..	..	18	4	4	..	..	..
I. " "	Castelfidardo.	" *Caval.* Cacace.	4,250	700	484	27	..	..	22	1	4	..	..	..
I. " "	San Martino.	" " Roberti.	4,250	700	484	26	..	..	16	6	4	..	..	..
W. " "	Principe de Carignano.	" " Jauch, Rear-Adm. Vacca.	4,086	600	440	22	..	..	12	6	4	..	..	..
I. Ironclad Turretship.	Affondatore.	" " Martini.	4,070	700	290	2	2	..	..	..	..	..	..	..
I. Ironclad Corvette....	Terribile.	" *Barone* de Cosa.	2,700	400	356	20	..	..	10	6	4	..	..	..
I. " "	Formidabile.	*II Capt.* *Caval.* di Saint-Bon.	2,700	400	356	20	..	..	10	6	4	..	..	..
I. " "	Palestro.	" " Capellini.	2,000	300	250	5	..	2	..	..	2	..	..	1
I. " "	Varese.	" " Fincati.	2,000	300	250	4	..	2	2	..	..	..	..	..
W. Screw Frigate.....	Duca di Genova.	*I Capt.* " di Clavesana.	3,515	600	580	50	..	..	..	8	..	10	32	..
W. " "	Carlo Alberto.	*II Capt.* " Pucci.	3,200	400	580	50	..	..	..	8	..	10	32	..
W. " "	Vittorio Emmanuele.	*I Capt.* *Duca.* Imbert.	3,415	500	580	50	..	..	..	8	..	10	32	..
W. " "	Garibaldi.	" " R. Vitagliano.	3,680	450	580	54	..	..	..	8	..	12	34	..
W. " "	Principe Umberto.	" *Barone* Guglielmo Acton.	3,501	600	580	50	..	..	..	8	..	10	32	..
W. " "	Gaeta.	" *Caval.* Cerruti.	3,980	450	580	54	..	..	..	8	..	12	34	..
W. " "	Maria Adelaide.	" " di Monale, Vice-Adm. *Conte* Albini.	3,459	600	550	32	..	..	..	10	22	..	..	..
W. Screw Corvette	San Giovanni.	*II Capt.* " Burrone Lercari.	1,780	220	345	20	..	..	..	6	..	14	..	..
W. Paddle Corvette	Governolo.	" " Gogola.	1,700	450	260	10	..	..	..	..	..	10	..	..
W. " "	Guiscardo.	" " Pepi.	1,400	300	190	6	..	..	..	2	..	..	4	..
W. " "	Eltore Fieramosca.	" " Baldissarotto.	1,400	300	190	6	..	2	..	..	..	..	4	..
Screw Gunboat	Montebello.	" " Sandri.	262	60	63	4	..	..	..	..	..	..	..	4
" "	Vinzaglio.	" " Foscolo.	262	60	63	4	..	..	..	..	..	..	..	4
" "	Confienza.	*Lieut.* " A. Conti.	262	60	63	4	..	..	..	..	..	..	..	4
Paddle Aviso.....	Messaggiere.	*II Capt.* " Giribaldi.	1,000	350	108	2	..	..	..	..	..	..	..	2
W. " "	Esploratore.	" " Orengo.	1,000	350	108	2	..	..	..	..	..	..	..	2
" "	Giglio.	*Lieut.* Denigri.	250	60	26	..	..	..	..	..	..	..	..	..
Hired Paddle Aviso..	Flavio Gioia.	" Moro.	2,000	350	108	..	..	..	..	..	..	..	..	..
" " ..	Stella d'Italia.	" Berlingieri.	2,000	350	108	..	..	..	..	..	..	..	..	..
Paddle Storeship	Indipendenza.	" Liparacchi.	600	300	98	2	..	..	..	..	..	..	..	..
Screw Hospital Ship.	Washington.	" Ziccavo.	1,400	250	98	2	..	..	..	..	..	..	..	..
Hired Paddle Vessel.	Piemonte.	?	?	?	?	..	..	..	..	..	..	..	..	..
			86,022	14,160	10,886	645	4	6	140	126	56	74	218	17

NOTE.—The elongated projectile for the 10 in. gun weighed 295 lbs.; the elongated projectile for the 8 in. Armstrong gun, 147 lbs.; the steel bolt for the 7 in. R. gun, 107 lbs.; the elongated shell for the 7 in. R. gun, 74 lbs., and the steel ball for the 8 in. S. B. M., 54 lbs.

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A USEFUL LITTLE CHANGE IN THE PELORUS.

By Lieut.-Commander Bradley A. Fiske, U. S. N.

When navigating the Petrel among the little straits and bays and rivers that skirt the coast of Asia, I devised a little change in the Pelorus, that seemed to me to improve it greatly. The change was so slight in construction, and made the instrument so much easier to handle, that I have intended for some time to mention it in print, but have been deterred by the fear that the plan is old. I have been unable to find that it is old, however; and so I feel emboldened to mention it, hoping that it may be of use to some.

The reason for making the change, was that it was found very hard to use the ordinary Pelorus quickly enough, when doing such things as entering the Yangtse, where currents are very strong and shoals numerous, and the ship was yawing from side to side. To attempt to take three bearings close enough together, was extremely difficult, if the ordinary method was employed of clamping the Pelorus on the ship's course, and waiting each time till the ship got on it. And we found the other plan of noting the number of degrees by which the ship was off the course, and applying it to the bearing by the Pelorus, gave too much chance of making mistakes.

So the clamp was removed from the Pelorus, and the sight vanes and their connecting bar raised about ⅛ inch, soldering brass strips of this thickness under the ends of the bar, so that the bar rested on the outer or stationery circle. The weight of the bar and vanes was sufficient to hold them at any place where they were put, in taking a bearing. Then the graduated plate was raised about 1/16 inch, by putting a washer of this thickness

under its center. The result of this was, that the graduated plate could be moved around very quickly by the finger.

Suppose now that it was wanted to get three bearings very quickly, on—say a light ship, a lighthouse and a beacon.

The quartermaster was stationed at the compass, and told to sing out the direction of the ship's head, when the officer taking the bearing called " Mark." When ready, the officer sighted the vanes on the light ship, and called " Mark." The vanes stayed where put, the quartermaster sang out—say " North," the officer set the graduated plate instantly at North, and noted the graduation (compass bearing) under the vanes. Then he sighted the vanes on the lighthouse, and called out " Mark." Suppose the quartermaster then reported " North 3° E." The inner circle was instantly moved to that point, and the bearing under the vanes noted. Then the vanes were sighted on the beacon, and the same process repeated.

This plan was used probably a nundred times under conditions of very quick motion, strong currents and narrow channels.

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LETTER FROM THE SENIOR SQUADRON COMMANDER U. S. NAVAL FORCE ON ASIATIC STATION.

FLAGSHIP KENTUCKY.

Cavite, P. I., April 13, 1901.

Sir:—There appears on page 638 of the PROCEEDINGS OF THE U. S. NAVAL INSTITUTE, No. 96, the following paragraph in the article entitled "Operations in North China," by Lieutenant W. C. Davidson:

"Later, on the 14th of June, a force of about 800 allied troops, which had been landed at Tongku, were peremptorily ordered to return to their ships by the Chinese general commanding the Taku forts at the mouth of the Pei Ho. At this, the foreign naval commanders held a conference, at which, the American admiral dissenting, it was decided to take possession of the forts, in order to avoid further trouble with them, and an ultimatum was accordingly sent to the Chinese general on the 15th, demanding that he evacuate the forts before 2 A. M. of the following day."

As this statement, coming from an American naval officer who served in North China, although not until after the capture of the Taku forts, and published by the U. S. Naval Institute, would seem to carry with it a certain weight of authority, and consequently mislead many people in regard to the true history of events, which caused a rupture with the Chinese Imperial troops, I cannot allow it to pass without calling attention to the great error this officer has made in the reason he gives for the ultimatum being sent by the foreign naval commanders to the Chinese general commanding the Taku forts.

On no occasion did any Chinese official order troops of the

allied forces to return to their ships, or even make a protest or offer objection to their landing.

On the other hand, the Russians and the Germans, June 15, prevented a force of Chinese troops from going from Lutai by train to Tongku and Chin Liang Cheng, by the former seizing the railroad station at Tientsin and Chin Liang Cheng, and the latter prohibiting trains from leaving Tongku. The telegram from the Chinese to the station-master at Tongku, ordering a train sent to Lutai, for the purpose of conveying Chinese troops from there to Tongku and Chin Liang Cheng, was obtained and read by Lieutenant Blue, who was stationed at Tongku at the time, as well as a similar telegram, countermanding the order for the train, after the action taken by the Russians and the Germans.

This matter is only referred to in this connection, as it might possibly be this case that Lieutenant Davidson, who arrived about two weeks subsequently, confused in his statement about 800 of the allied troops being peremptorily ordered back to their ships.

Very respectfully,

JAMES KEMPFF,

Rear-Admiral, U. S. Navy, Senior Squadron Commander.

The Secretary of the Naval Institute,
Annapolis, Md.

DISCUSSION.

"OUR NEW BATTLESHIPS AND ARMORED CRUISERS." See No. 96.

Lieut. W. L. RODGERS, U. S. N.—After describing the contrasting features of the Virginia and Maryland, Mr. Taylor's paper concludes by asking the service several questions in regard to the choice of types.

These questions can be answered only after coming to some conclusions as to the tactical value of each increment of one knot's speed. Or in other words, we must have an approximate idea as to what weight of gun-fire is the equivalent of one knot of speed. The subject is thus to be regarded from a tactical standpoint.

I shall make three or four tactical premises from which and from the data on design given by Mr. Taylor, I shall endeavor to draw some conclusion as to the highest speed necessary for battleships. Of course, if the tactical premises are in any degree erroneous, the conclusions are proportionately valueless; but if by discussion and comparison of views we can ascertain that certain tactical ideas are generally acceptable, then I think we may trust our deductions based upon them as to proper speed.

It seems clear that between two hostile ships or squadrons similarly armed and protected which are manœuvring for effective position for the best use of their weapons; the advantage of one knot's superiority of speed becomes less as the speeds become higher; for the reason that each adversary can move more quickly to escape from a position of tactical inferiority.

Moreover, the more quickly the vessels move, the more difficult it will be for a captain or admiral to perceive and seize the fleeting opportunities which offer themselves for the proper employment of the advantages which undoubtedly lie in superior speed.

It must also be remarked that each successive knot of speed requires an ever increasing sacrifice in the weights devoted to battery, ammunition and armor.

Another important point is that the more equally the fire of the battery commands all points of the horizon, the less tactical advantage is conferred by a given superiority of speed; since change of relative position entails less relative change in effective gun-fire. The difficulty is thus to decide upon the approximate speed at which the tactical superiority of manœuvre conferred by an increment of speed is counterbalanced by the necessary sacrifice in the weight of broadside and protection.

Let us take the Virginia as a standard and ascertain approximately what changes in her armament correspond to variations in her speed.

Mr. Taylor states that her machinery weighs 1800 tons; develops 19000 H. P., and gives 19 knots speed. His figure 4 shows the H. P. necessary for reduced speeds of the Virginia and Maryland. He mentions also the greater weight of hull in the Maryland on account of her greater length. From these data I have made up the following table which

roughly shows the weights available for combatant purposes corresponding to variations in the maximum speed.

	1 Ship.	2 Maximum speed. Knots.	3 Displacement. Tons.	4 Machinery Weights. Tons.	5 Armor, Battery, Ammunition. Weights. Tons.	6 Armor, Battery, Ammunition. Percentage of weights of Virginia.	7 Relative efficiency of armament compared to that of Virginia.
1	Modified Virginia.	13	14,600	395	6217	129	149
2	" "	14	"	485	6127	127	145
3	" "	15	"	610	6000	124	141
4	" "	16	"	755	5857	121	136
5	" "	17	"	970	5643	118	130
6	" "	18	"	1260	5353	110	120
7	Virginia.....	19	"	1796	4817	100	100
8	Modified Virginia.	20	"	1950	4370	90	84
9	" "	21	"	2100	3900	80	66
10	" "	22	"	2265	3400	69	45
	No. 10 is enlarged Maryland.						

The figures in column 7 marked "relative efficiency of armament" are based on those in column 6 and on the assumption that the general fighting efficiency of guns and protection will vary in a greater ratio than that of the weights actually devoted to the whole system adopted. Although the figures in column 7 are somewhat conjectural representing only an individual's opinion, yet figures lend themselves for comparison readily; and we have a convenient approximate scale to compare a little later, the tactical value of different maximum speeds.

From a tactical standpoint superior speed may confer on a combatant a relative advantage of position with regard to the use of each of the three arms, gun, ram and torpedo.

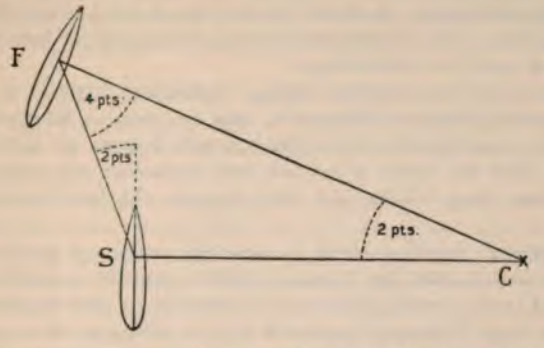
With regard to gun-fire superior speed coupled with superior target practice enables a ship to hold that range at which the superior skill is most effective. Equal speed will prevent the enemy from closing. If one needs speed to close, it is because the shooting is inferior at long ranges, and it would be better to devote efforts to target practice before the war, rather than build with a high speed to make up for defects in drill.

Superior speed may also be used to occupy and endeavor to hold a position such that the maximum gun-fire of one vessel is opposed to the minimum of the other. This problem merits examination.

Let us consider two ships of the usual battery of our service consisting of two heavy turrets on the midship line, some eight-inch turrets and a broadside battery of 5-inch or 6-inch guns, such as the Indiana, Kentucky

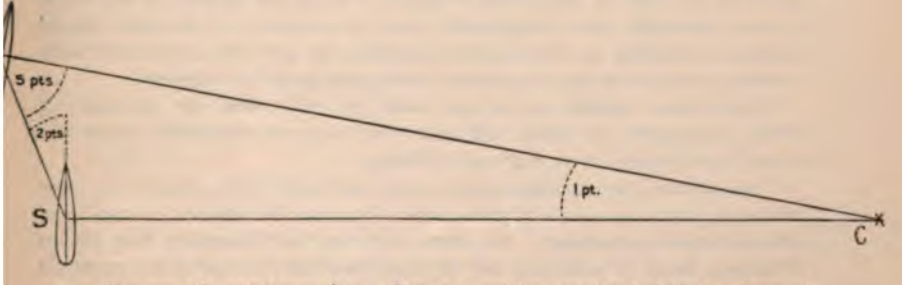
and Virginia. In all these ships the maximum fire covers eight points on each broadside; four points forward and four abaft the beam.

In all, the minimum fire is about two points on each bow and greater and, except in the Kentucky, there is a heavier fire fore and aft than in a direction two points from that line. In none does the minimum fire vary much from 60 per cent of the maximum.



The diagram represents a situation where F (the fast ship) brings her whole broadside against S's least fire. This situation may be maintained by F if both ships circle about the point C. With speeds proportional to their distances from C. Or it may be maintained if F shifts her helm so as to follow a wave line course ahead of S. The latter plan would interfere with the fire of the six-inch battery as regards rapidity.

In the first case the speeds must be as 13 to 10 for F to maintain his superiority. Any less difference will be useless to F; more will be superfluous. If the arrangement of battery of F is altered so as to allow her to cover ten points on each beam with her maximum fire instead of eight points it appears by reconstructing the diagram that a superiority of 10 per cent of speed will do as much for as 30 per cent would do with



a smaller arc of maximum fire. But it must be recollected that a turn of the helm on the part of S will bring his maximum fire to bear, so that while a superiority of 13 to 10 in speed is the least that can be useful to F, the possibility of employing it effectively depends almost entirely

upon S, and upon his committing most unlikely errors in judgment. Turning to column 7 of the table, and taking 15 knots as the speed of S and 20 knots as the speed of F, these being in the ratio of 10 to 13; we find that 60 per cent of the efficiency of fire of S is equal to the whole efficiency of F. If the data and arguments on which the table is based are reasonable, it appears from it that under the circumstances most favorable to speed it will be impossible that a battleship faster than 15 knots shall compensate in action by her speed for her sacrifice of guns and protection. This statement does not mean that 15 knots should be the limiting speed for battleships.

For the use of the torpedo between battleships little is to be gained by high speed; because although it may be used to attempt to gain a position of advantage the slow ship has only to turn so as to bring her adversary abaft the beam when her own torpedoes are more favorably situated than those of the fast ship in case the latter persists in his approach.

For ramming, superior speed is essential, because a position suitable for a ram attack must be occupied before actually committing oneself to it. That is, the vessel about to ram must be so placed before attempting it as to make it almost impossible for the enemy to turn stem to stem, and so to collide with equal chances and fortuitous result. Thus favorable positions for ramming are mostly abaft the opponent's beam and so superior speed is necessary in order to reach him.

Let us assume that a superiority of five knots is necessary to strike an effective blow from astern. Let us also assume that the extreme range for effective shooting is 5000 yards. If then, a vessel tries to ram a battleships the latter will have half an hour in which to disable the former while she tries to approach from astern.

To get some idea as to the time—effectiveness of gun-fire, let us consider the battle of Santiago. In this action, an hour of firing destroyed the Spanish fleet at ranges which were never short and with shooting which seems not to have been good. The efficiency of armament of the Indiana considering her date of design and other features is probably about 75 per cent of that of the Virginia. From the results of the battle it seems probable that a superiority of 60 in column 7 of the table would enable a battleship to destroy her adversary by gun-fire in the half hour necessary for the latter to advance from 5000 yards to collision.

Under these conditions we see from the table that the necessary 5 knots' superiority in speed will cost too much in armament when the slow vessel's speed is as high as 16 knots.

If the above line of reasoning is even approximately correct, our new battleships have a much higher speed than can be utilized in battle to obtain tactical advantage. We must not conclude therefore that fifteen or sixteen knots is sufficient; for we must recollect that speed is a strategic factor, and when superior it confers the ability to force or refuse a battle, and to escape when defeated. But as battleships are not built to run away, but are meant for fighting, I think a speed barely equal to that of other navies is quite enough. Examples from history show that for

attack a fleet is as fast as its fastest ships; yet for retreat it is no faster than its slowest ship.

So if our battle fleet is slightly inferior in speed to our adversary the latter will never be able to get away without fighting, if once it is sighted. The fact that if our ship tries to escape it may lack speed to do so, is not to be considered in battleship design.

Logically, the fastest battleships should belong to that country whose political situation requires it to maintain the most powerful navy. In this way it can always be sure of the battle which its strength causes it to desire.

As foreign battleships are now making 19 knots, I think 18 knots is enough for us. Let us make sure of heavy batteries and well trained crews, and then try to make up the difference in trial speed by assiduous care of the machinery.

If we look at the table to compare an 18 knot with a 19 knot Virginia, we see that the latter would have an advantage of over 500 tons in available weights for guns and armor. By doing away with the 6-inch battery, an 18 knot ship might be designed to carry four 12-inch guns in two turrets, four 8-inch turrets like the Indiana, two superposed 8-inch turrets like the Kentucky and eight 8-inch guns in broadside casemates, making a main battery of four 12-inch and 20 8-inch guns. If the difficulties in ammunition supply are not too great for solution, this battery would be the heaviest afloat, and to my mind it is a feature cheaply purchased by the loss of only a knot in speed.

PROFESSIONAL NOTES.

Prepared by Lieutenant L. S. VAN DUZER, U. S. Navy.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

AUSTRIA.

ARPAD AND BABENBERG.—The other two battleships of the Habsburg class are to be called the Arpad and Babenberg.

DANUBE FLOTILLA.—The present Danube flotilla, consisting of four small river monitors, is regarded as insufficient and it is proposed to build two more, if possible to secure the approval of the Imperial Parliament.

PERSONNEL OF THE NAVY.—The enlisted force of the Austrian Navy consists of 22,119 men divided racially as follows: Germans, 3049; Magyars, 1373; Czechs, 1463; Slovacks, 119; Poles, 463; Slavs, 523; Servo-Croats, 8721; Bulgarians, 12; Roumanians, 30; Italians, 6263. The nationality of the others is not reported.

COLOMBIA.

It is reported that the large steel steam yacht Namouna has been sold to the Colombian government by her owner, James Gordon Bennett of the *New York Herald*, and will be converted into a lightly armed cruiser.

DENMARK.

HERLUF TROLLE: TRIAL, DESCRIPTION.—This third class, low-freeboard, battleship has completed her trials. The maximum speed was 15.65 knots with 4399 I. H. P.; the mean speed on trial was 14.6 knots and the mean horsepower 3170.

The keel of this vessel was laid on the royal dockyard, Copenhagen, in 1896, and she was launched September 2, 1899. The hull is of steel without sheathing. The freeboard is low, the main deck being only about three feet above water. Forward, a bow superstructure extends from the stem to the forward turret, the forward turret gun being highly placed so as to fire over it. Between the turrets there is a central superstructure not quite as wide as the upper deck. There are two masts, each carrying one military top. The complement is 250 men.

Armament.—Two 9.4-inch guns in closed, balanced turrets, one forward, one aft. Four 5.9-inch guns on the main deck in armored casemates in the corners of the central superstructure. Ten 6-pounders: three each side on the superstructure; and two each side in the superstructure between the 5.9-inch casemates. Eight smaller guns. Three submerged torpedo tubes: one beneath the ram and one training tube on each beam.

Protection.—Nearly complete belt, 7 feet wide, and 261.4 feet long, ex-

tending from the stern to within ten feet of the bow where it ends in a vertical, transverse bulkhead 6.9 inches thick. The belt extends from 3.6 feet below water to the main deck and is 6.9 to 7.9 inches thick. The armor deck over the belt is flat and 2.24 inches thick; beyond the belt a submerged protective deck extends to the stem. The casemate armor is 5.9 inches thick in front and 2.56 inches in rear. The turrets are 6.9 inches thick in front and 5.9 inches in rear and rest on barbettes, 6.9 inches thick, rising a foot or so above the armor deck. The conning-tower is 7.9 inches thick in addition to an inner skin 1.1 inches thick. The armor of the belt, turrets, and conning-tower is of chrome-nickel steel.

Motive power.—Twin-screw, triple-expansion engines, designed to develop 4200 I. H. P. and give a speed of 15 knots. There is one smoke-pipe.

Dimensions.—Length between perpendiculars, 271.9 feet; beam, extreme, at waterline, 49.5 feet; normal draught, 16 feet forward and aft; displacement at this draught, 4200 tons.

ECUADOR.

GUNBOATS PURCHASED.—It is reported that the Ecuadorian government has purchased the old French gunboats Papin and Inconstant. These two vessels are composite built and have been condemned as not worth repair, partly because of age and condition and partly because of their design being unsuited to present requirements. They are sister ships and have the following dimensions: Length, 199.5 feet; beam, 23.4 feet; mean draft, 12.75 feet; displacement, 811 tons. The armament consists of two 5.5-inch breech-loading guns of old type; one 3.9-inch gun of similar type; and five 37-mm. revolving cannon. The engines are single-screw, horizontal, compound; boilers, 6, each with one furnace. Horsepower about 860 and speed when new, 12 knots. The coal capacity is about 150 tons.

FRANCE.

BUDGET FOR 1902.—The budget for 1902 as submitted to the Chambers calls for an expenditure of 340,508,183 francs ($65,718,079.32—1 franc = $0.193), an increase of 12,815,553 francs over that of 1901. As it has not yet been approved by the Chambers it is useless to mention details.

PROPOSED INCREASE OF LISTS OF OFFICERS.—The proposed changes are shown in the following table:

	Present list.	Proposed list.
Vice-admirals	15	15
Rear-admirals	30	30
Captains (capitaines de vaisseau)	125	125
Commanders (capitaines de frégate)	215	215
Lieutenent-commanders (capitaines de corvette)	—	150
Lieutenants (lieutenants de vaisseau)	754	870
Ensigns (enseignes de vaisseau) / Midshipmen of first class	599	700
Total	1738	2105

	Present list.	Proposed list.
Mécanicien inspecteur général	1	—
Inspector général mécanicien (vice-admiral)	—	1
Mécanicien inspecteurs	6	—
Directeurs du service des machines (contre-amiraux)	—	2
Mécaniciens en chef	20	—
Mécaniciens en chef de 1re classe (cap. de vaisseau)	—	6
Mécaniciens en chef de 2e classe (cap. de frégate)	—	15
Mécaniciens principaux (capitaines de corvette)	—	30
Mécaniciens principaux de 1re classe	100	—
Officiers mécaniciens de 1re classe (lieutenant de vaisseau)	—	170
Mécaniciens principaux de 2e classe	200	—
Officiers mecaniciens de 2e classe (enseignes de vaisseau)	—	270
Total	327	494

The mécaniciens principaux (capitaines de corvette) will be detailed as chief engineers of armorclads, which have engines of 16,000 I. H. P. or more. The mécaniciens en chef de 2e classe, will be assigned as chief engineers of divisions. The mécaniciens en chef de 1re classe will serve as fleet engineers and, with the directeurs du service des machines, in the ports.

NEW SHIPS.—The two new battleships which were described in *No. 97*, page 156, are to be called the Republique and the Patrie; the former is to be built at Brest and will be laid down as soon as the Leon Gambetta is launched. As the Gambetta has scarcely been commenced the laying down is not likely to take place till towards the close of 1901. The Victor Hugo, an armored cruiser of the Gambetta class, is to be commenced at Toulon. The ten torpedo-boat destroyers referred to as likely to be built (see page 154, *No. 97*) have all been, or are about to be, ordered. The two under construction at Rochefort are to be called the Francisque and Sabre; the eight which are to be built in private yards have received the names Dard, Baleste, Mousqueton, Arc, Pistolet, Belier, Catapulte, and Bombarde. Two of last year's program, the Mousquet and Javeline, have just been contracted for. The torpedo boats which are to be built in private yards, eleven in number, have all been contracted for. They will have a displacement of 87 tons, a speed of 24 knots, and their numbers are to be 266 to 276 inclusive. Three new submarine boats have been commenced. They are of different types and are not included in the list hitherto provided for, but are designed as experimental boats in which to study various features. Through some oversight the list of submarine boats building in France was omitted from the list of vessels given in *No. 97*, page 154. The list corrected to June 1, is here supplied:

Name.	Displacement.	Where building.	Remarks.
Morse type.			
Français	146	Arsenal, Cherbourg.	Launched Jan. 25, 1901, and undergoing trials.
Algérien	146	" "	Launched April 27.
Farfadet	185	Arsenal, Rochefort.	Launched May 17.
Gnome	185	" "	Building.
Korrigan	185	" "	"
Lutin	185	" "	"

Name.	Displacement.	Where building.	Remarks.
Narval type.			
Sirène	106	Arsenal, Cherbourg,	Launched May 4
Triton	106	" "	Building.
Silure	106	" "	"
Espadon	106	" "	"
New boats.			
Three experimental boats	?	?	Building.
Perle	70	Arsenal, Brest,	Ordered; not begun.
Bonite	70	" "	" "
Esturgeon	70	" "	" "
Thon	70	" "	" "
Souffleur	70	" "	" "
Anquille	70	" "	" "
Aloze	70	" "	" "
Dorade	70	" "	" "
Truite	70	" "	" "
Grondin	70	" "	" "
Four boats	70	Arsenal, Cherbourg,	" "
Six boats	70	Arsenal, Rochefort,	" "

VICTOR HUGO: DESCRIPTION.—This armored cruiser is to be laid down at Toulon during the summer. She is a sister ship to the Leon Gambetta and Jules Ferry now under construction. The complement is 690 men and 38 officers. Her external features may be understood from the illustration facing this page. The principal details are:

Armament.—Four 7.6-inch guns in pairs in turrets forward and aft. Sixteen 6.48-inch guns: twelve in pairs in six turrets, three each side; and four singly in casemates. Twenty-two 3-pounders. Ten machine guns. Two submerged torpedo tubes and three above water tubes.

Protection.—Complete belt, 6.7 inches to 4 inches thick; above this, side armor in the form of another belt, 5 inches to 3 inches thick. The turrets of the 7.6-inch guns are 6 inches thick and have 7.7-inch bases. Small turrets, 5.5 inches. Casemates, 4 inches.

Motive power.—Triple screw engines of 27,500 I. H. P., designed to give a speed of 22 knots (which it most certainly will—probably 23). Boilers, water-tube; type not settled. Coal supply, normal, 1320 tons; total capacity, 2100 tons—the additional 780 tons being in the form of briquettes.

Dimensions.—Length, 480.7 feet; beam, 70.2 feet; draft, 26.25 feet; displacement, 12,500 tons.

DESAIX: LAUNCH, DESCRIPTION.—This armored cruiser is building at the yard of the Société des Ateliers et Chantiers de la Loire, St. Nazaire, where she was launched March 21. She is a sister ship to the Dupleix, launched a year ago, and to the Kléber, still on the ways. The hull is of steel, sheathed with wood and coppered. The principal details are:

Armament.—Eight 6.48-inch guns in pairs in four turrets; one forward, one aft, and one on each side amidships. Four 3.9-inch guns. Ten 3-pounders. Four 1-pounders. Two above-water torpedo tubes.

Protection.—Water-line belt, 4.3 inches thick amidships, extending from the stem to within 65 feet of the stern. It rises 3.3 feet above water and descends 3.9 feet below it; toward the bow it rises 9.8 feet above water. Complete protective deck, 1.77 inches on the flat and 2.76 inches on the slopes. Cofferdam around the water-line just inside the armor, extending the full height of the space between the two decks covered by the

FRENCH ARMORED CRUISER VICTOR HUGO.
From the Engineer.

belt. It is proposed to fill the cofferdam with obturating material. Inboard of the cofferdam is a passage way. On the first deck above the belt there are fitted on each side partial partitions extending inboard from the sides of the vessel, and producing the effect of a number of wide stalls. These are fitted on the Jeanne d'Arc and vessels similar to her, and are made of metal not thicker than 0.08 inch, and have a beading on the inboard edge. They are placed at every fourth beam and extend nearly the entire length of the deck, being discontinued only at the ends, where the sides begin to curve markedly toward the bow and stern. They are intended to localize water in case the vessel should take a marked heel through injury in battle. They are secured inboard to a fore and aft strip about 18 inches in height. Turret armor, 5.5 inches.

Motive power.—Triple-screw engines designed to develop 17,100 horsepower at 150 revolutions and give a speed of 21 knots. Twenty-four Belleville boilers, in eight fire-rooms, with a total grate area of 1076 square feet. Coal supply, normal, 880 tons; total capacity, 1200 tons.

Dimensions.—Length, 426.5 feet; beam, 58.66 feet; mean draft, 22 feet; displacement, 7710 tons (metric).

IÉNA: TRIALS, DESCRIPTION.—This battleship is very similar to the three of the Charlemagne class and differs chiefly in the caliber of her heavy auxiliary guns, in having a nearly straight stem, and in the different arrangement of the upper part of her superstructure and military tops. There are two military masts, each carrying a domelike top—that on the mainmast being placed quite low. A photograph of the ship will be published in these notes as soon as she is fully completed for service. The hull is of steel, without sheathing. The principal details are:

Armament.—Four 12-inch guns in pairs in turrets forward and aft. Eight 6.48-inch guns in central casemate like the lower eight 5.5-inch guns of the Charlemagne, forward four firing directly ahead and after four directly astern. Eight 3.9-inch guns on the superstructure, four each side. Sixteen 3-pounders. Sixteen 1-pounder and light guns. Four torpedo tubes, two of which are submerged.

Protection.—Complete water-line belt, 13.8 inches thick amidships and 5.9 inches at the ends. Secondary belt above this 4.7 inches thick. Two protective decks—upper one 2.5 inches and lower one 0.79 inch—meet the top and bottom edges of the belt at the side and the space between them is closely subdivided. Between the top of the belt and the lower edge of the casemate of the 6.48-inch guns there is an unarmored space about four feet wide. Thickness of turrets, 11.8 inches; of casemate armor, 4.7 inches.

Motive power.—Triple-screw, 4-cylinder, triple-expansion engines designed to develop 15,500 I. H. P. and give a speed of 18 knots at 125 revolutions. Twenty Belleville boilers. Normal coal supply, 820 tons; total capacity for coal, petroleum, and briquettes, 1100 tons. The trials have all been completed except that at full power. The results, as far as attained, are:

Date of trial	Mch. 26	Mch. 31	Apr. —
Number of boilers in use	14	20	20
Duration of trial, hours	6	6	6
I. H. P.	5504	12,500	9830
Speed	13.8	17.4	16.3

She has suffered much from hot bearings, said to be owing to too light construction of the hull. *Le Yacht* says that she is one of the few vessels in the French navy which is floating above her designed water-line, and thus possessing a reserve of displacement.

Dimensions.—Length on water-line, 400.75 feet; beam, 68.37 feet; draft aft, 27.5 feet; displacement, 12,052 tons (metric).

SABRE, FRANCISQUE, DARD, BALESTE, MOUSQUETON, ARC, PISTOLET, BELIER, CATAPULTE, BOMBARDE, MOUSQUET, JAVELINE: DESCRIPTION.—These torpedo-boat destroyers are, or are about to be, ordered. The first two are to be taken in hand at Rochefort without delay and the Mousquet and Javeline, which really belong to last year's program, were recently ordered from the Ateliers et Chantiers de la Loire. The principal dimensions are: length, 183.7 feet; beam, 19.7 feet; draft, 9.35 feet; displacement, a little less than 300 tons. The horsepower of the machinery will be 6300 and the expected speed 28 knots. The hull will be of nickel steel. The armament will consist of one 2.56-inch gun, six 3-pounders, and two torpedo tubes. The cost of the Mousquet and Javeline is 1,450,000 francs each. This description is that furnished for the last-named boats alone, but it is believed to be practically correct for the others.

MISTRAL, SIROCCO, SIMOUN: LAUNCH, DESCRIPTION.—These sea-going torpedo boats of 180 tons have been launched; the Mistral at the works of A. Normand & Co., Havre, May 4; the Sirocco at the same yard February 20; and the Simoun at the Graville (Havre) yard of the Forges et Chantiers de la Méditerranée March 25. They are believed to be similar in all essential respects. The dimensions are: Length, 155.6 feet; beam, 16.1 feet; draft, 8.5 feet; displacement, 180 tons. The engines are twin-screw, vertical, triple-expansion, designed to develop 4200 I. H. P. and give a speed of 26 knots. The armament consists of two 3-pounders and two torpedo tubes.

TORPEDO BOAT NO. 242: LAUNCH.—This torpedo boat of 90 tons, 1800 I. H. P., and 24 knots speed, was launched at the Saigon Arsenal, April 20. It was to have been fitted with turbine motors and six screws, but perhaps the design was changed.

PIQUE, EPÉE: TRIALS.—Torpedo-boat destroyers of 313 tons displacement, designed for a speed of 26 knots with 5700 I. H. P. The Pique's first official trials took place in October last, but as the speed attained was only 24 knots, it was decided that new screws would be necessary before the required speed could be reached. In February she ran a trial of five hours duration, maintaining a speed of 22.25 knots with 268 revolutions of her engines, and for one hour a speed of 25.58 knots with 298 revolutions. The latter trial was interrupted on account of a hot guide, but she made another attempt in March, reaching 25.5 knots with 297 revolutions.

The Epée has had preliminary trials during which she reached a speed of 25.621 knots. Subsequently she made 19.15 knots with one group of boilers in use.

ALGÉRIEN: LAUNCH.—The submarine boat Algérien, a sister to the Français (partly described on page 157, PROCEEDINGS *No.* 97), was launched at the arsenal, Cherbourg, April 27. The armament consists of a torpedo tube forward and a launching apparatus on each side. The cost is 760,000 francs.

SIRÈNE: LAUNCH, DESCRIPTION.—This submarine boat of the submergible type was launched at Cherbourg on May 4. She is the first of four to take the water; and her sisters, the Triton, Silure, and Espador, will follow shortly. This model is a development of the Narval type which it resembles closely. The Narval, as we know, consists of a tube—or fusiform shell—which forms the boat proper, and is strong enough to resist the pressure at very considerable depths. Surrounding this there is a second shell closely resembling in form the hull of an ordinary surface torpedo boat, but with fewer projections and irregularities in contour. The space between the two hulls is used for water ballast and when fully submerged is sufficiently open to the sea so that the external pressure is transmitted to the interior hull, while the exterior hull is kept without strain. The defects of the system as exemplified in the Narval are that the means of admitting water evenly and steadily are not sufficiently rapid and the submerging is further delayed by the change from steam propulsion to electric. The defects herein referred to render it impossible to submerge the Narval in less than 15 or 20 minutes—a wholly impermissible interval—but the new boats are expected to do better.

The Sirène has the following dimensions: Length, 111.55 feet; beam, 12.3 feet; draft when moving on the surface, 5.25 feet; displacement in this condition, 106 tons. The appearance when running on the surface is that of a rather low torpedo boat with vertical sides; a flat and very clear deck is slightly rounded at the sides to meet the side plating. A further description of the exterior is dispensed with as it is hoped to present the latest photographs of the Narval and other submarine boats in the next number of the PROCEEDINGS. The propelling machinery consists of a vertical, triple-expansion engine of 217 I. H. P., supplied with steam by a water-tube boiler, and gives a speed of 10 to 12 knots when running as an ordinary surface boat. In this condition the boat can charge the accumulators which she uses when running submerged. The radius of action under steam is 400 to 500 miles. The armament consists of four sets of 17.7-inch torpedo launching apparatus.

FARFADET: LAUNCH, DIMENSIONS, ETC.—The submarine boat Farfadet, of the improved Morse type, was launched at Rochefort arsenal on May 17. She was commenced September 27, 1899, and is the first of her class to be launched. The others are the Gnome, Lutin, and Korrigan. The plans are by M. Mangas. The dimensions are: Length, 135.67 feet; beam, 9.5 feet; maximum draft and depth amidships, 9.5 feet; displacement, 185 tons when submerged, and slightly less when running at the surface. Like their prototype, the Morse, the vessels of this class are very long and slender. The speed, either at the surface or submerged, is expected to be about 12 knots. There is a single screw worked by electric power furnished by accumulators which are charged in the port to which the vessel is attached, or by some ship. The radius of action is small—perhaps 50 miles at the most economical speed. There are four sets of apparatus for launching torpedoes. The complement consists of an officer and eight men.

VERON SUBMARINE BOAT.—Experiments were recently conducted at Marseilles, France, with a submarine model, the invention of a boilermaker named Victor Veron, employed in a private shipyard. The inventor was highly complimented by Admiral Besson who witnessed the tests.—*Army & Navy Journal.*

GERMANY.

NEW ARMORED CRUISER.—The new armored cruiser C (ersatz Konig Wilhelm) is to be of 9800 tons instead of 8868, as are the Prinz Heinrich and Cruiser B. The increased tonnage is to be applied to additional protection, engine power, coal, and battery. The latter will consist of four 8.27-inch guns, ten 5.9-inch, and twelve 3.5-inch.

PANTHER: LAUNCH, DESCRIPTION.—The gunboat building at the government yard, Dantzic, was launched April 1 and named the Panther. She is a sister to the Iltis, Jaguar, Tiger, and Luchs. The general characteristics of this vessel are shown in the photograph of the Tiger on the opposite page, which was taken at the Naval Academy, Kiel. The principal characteristics are:

Armament.—Four 3.5-inch guns; eight 1-pounders; two machine guns.

Protection.—Steel watertight deck.

Motive power.—Twin-screw, triple-expansion engines designed to develop 1200 I. H. P. and give a speed of 13 knots. Coal supply, 120 tons; total capacity, 160 tons.

Dimensions.—Length, 203.4 feet; beam, 29.86 feet; mean draft, 10.8 feet; displacement, 899 tons.

FREYA: TRIALS.—The trials of this cruiser have been completed with satisfactory results, the data being:

Date	Mch. 21	Mch. 26-27	Mch. 29-30	——
Duration, hours	6	24	24	72
I. H. P.	10,600	1200	6000	6000

All these trials were completed in thirteen days, the last one being at a speed of 16 knots.

The Freya is a cruiser of 5650 tons displacement and of the following dimensions: Length, 344.4 feet; beam, 57 feet; draft, 21.67 feet. She has Niclausse boilers with 775 square feet of grate, and 25,834 of heating surface.—*Journal of the American Society of Naval Engineers.*

KAISER CLASS: DESCRIPTION, REMARKS, ACCIDENT TO KAISER FRIEDRICH III.—The vessels of this class are the Kaiser Wilhelm II, Kaiser Karl der Grosse, Kaiser Friedrich III, Kaiser Wilhelm der Grosse, and Kaiser Barbarossa. All have been launched, but the Kaiser Karl der Grosse and Kaiser Barbarossa may not be ready for service before the end of the year. The complement is 642 officers and men. The general appearance of the class is shown by the illustration on the opposite page. The principal details are:

Armament.—Four 40-caliber, 9.45-inch Krupp guns in pairs in turrets forward and aft. Eighteen 40-caliber, 5.9-inch Krupp guns: six in six small turrets on the upper deck amidships, three each side; two in casemates on the upper deck built up against the forward side of the forward 9.45-inch gun support; four in casemates on the upper deck, one each side abreast each mast; two in casemates on upper deck at after end of superstructure, firing over after 9.45-inch gun turret; two in casemates on main deck, one each side abreast forward 9.45-inch gun turret; two in casemates on main deck, one each side abreast mainmast. Ten 40-caliber, 5.5-inch guns, five each side, on superstructure deck behind shields. Twelve 1-pounders. Six torpedo tubes: one 46-centimeter tube above water in stern; one 53-centimeter submerged tube firing through fore foot; four 46-centimeter submerged tubes in broadside.

GERMAN GUNBOAT TIGER, WITH THE GERMAN NAVAL ACADEMY AT KIEL, IN THE BACKGROUND.

GERMAN BATTLESHIP KAISER FRIEDRICH III.

Protection.—Water-line belt extending from stem to abreast after turret where it sweeps inboard and encloses base of after turret. It is 6.5 feet wide, of which width 2.95 feet is above water at mean load; and its thickness is 11.8 inches amidships and 5.9 inches at the ends. The armor deck above the belt is 2.56 inches thick; below this there is a curved splinter deck 0.8 inch thick. The protective deck abaft the belt is 2.95 inches on the slopes. The turrets for the 9.45-inch guns are 9.8 inches thick and the smaller turrets and casemates 6 inches. The turrets do not rest upon armored barbette towers but are supported by framing and connection is made to the armor deck by armored loading tubes only. There are two conning-towers, the forward one 10 inches thick and the after one 4 inches.

Motive power.—Triple-screw, triple-expansion engines, designed to develop 18,000 I. H. P. and give a speed of 18 knots. The boilers of some of the class are partly cylindrical and partly water-tube; of the others, all water-tube. The coal capacity is 650 tons; in addition to which 229 tons of tar oil may be carried.

Dimensions.—Length between perpendiculars, 377.3 feet; beam, 66.9 feet; mean draft, 23.95 feet; displacement, 11,081 tons.

The particulars of the accident to the Kaiser Friedrich III are given in the following:

Kiel, April 3.—The flagship of Prince Henry of Prussia, the turretship Kaiser Friedrich III, grounded yesterday afternoon east of Arcona, owing to some unexplained cause. She arrived here this afternoon under her own steam and was docked. The damages she has sustained appear to be so extensive that she may have to be put out of commission.

It now appears that the accident was caused by bad steering, the vessel running into the shallows, near Bornholm Island, to approach which is forbidden to warships.

Soon after the battleship went aground a fire broke out from some cause unknown in the engine-room, and it was not quenched until after two hours' fighting, when the room was placed under water. The damage is serious, and several months will be needed for repairs.—*Baltimore American.*

The accident which befell the German battleship, Kaiser Friedrich III, flagship of Prince Henry of Prussia, near the Adlergrund last week, was more serious than was at first supposed, and might, but for the good work of those on board, have ended in a great disaster. The ship was steaming at full speed when she touched the ground, but passed over the obstacle, damaging, however, four of the watertight compartments, which began to fill. The doors were closed and the pumps set in action, while the ship was taken in tow by the Kaiser Wilhelm II, the engines having stopped. Meanwhile it was reported that fire had broken out in some of the bunkers. The shock of the collision had caused leakages in the tanks for storing the *masut*, or heavy residual oil of petroleum which is used for stoking, and this having flooded the stokeholds, these became masses of flame. After strenuous endeavors lasting three hours the fire was subdued, but it had been necessary to admit water to the stokeholds, storerooms, and magazines, and eight of the boilers were damaged. Prince Henry remained with the men directing the operations, and it would appear that at one time the possibility of having to abandon the ship was contemplated. The walls of the flooded compartments began to bulge owing to the pressure within, and had to be propped—an operation of

much danger. The stokers behaved with great gallantry, and the ship was saved. Two men were seriously burned, and the Kaiser Friedrich was badly damaged, but the accident might have resulted far more seriously. As it is, the ship will probably be in hand for repair during the whole of the present year, and the cost of the work is estimated at 3,000,000 marks. The Wilhelm der Grosse will take her place in the squadron. The Wilhelm II also touched the ground and damaged her propellers. —*Army & Navy Gazette*, April 13.

All the information accessible goes to show that the German battleship Kaiser Friedrich III was saved almost by a miracle. The heavy petroleum used for auxiliary stoking was stored in the bilge, and the water which invaded the ship floated it into the stokeholds. The watertight doors were closed, and all attention was devoted to extinguishing the fires and flooding the magazines, which were in danger. The fire was of a very serious nature, the engines and boilers were damaged, and the propellers were injured. It appears not yet to have been fully ascertained why the Kaiser Friedrich and her consort the Kaiser Wilhelm touched the ground to the south of the island of Bornholm. The shoal is the Adlergrund, and an officer was despatched to make a survey of the reefs, some uncharted rocks being discovered in the course of his survey. In ordinary circumstances there is a perfectly safe passage between the island and the mainland. Too much praise cannot be given to the ship's company, who worked with increasing energy to stifle the flames and to keep out the sea. The Emperor has conferred decorations upon Captain Thiele and several officers, engineers and stokers, who at the risk of their lives flooded the magazines. When waterproof sheetings had been lowered over the holes, 1000 tons of water were pumped out of the ship. The squadron was engaged at the time in its summer evolutionary cruise, which always precedes the manœuvres, and was returning from Danzig to Kiel. It had visited Sassintz and Rügen, and the programme includes visits to some foreign ports. The Kaiser Wilhelm der Grosse is to take the place of the Friedrich III.—*Army & Navy Gazette*, April 27.

Brandenburg Class: Reconstruction.—The battleships of the Brandenburg class are to be taken in hand for reconstruction. The midship 11-inch guns, mountings, and armor are to be removed and replaced by a battery of 5.9-inch guns protected by armor.

Hagen, Hildebrand, Beowulf, Heimdal: Reconstruction.—The three last named, all of which are of the Siegfried class, will be reconstructed on the same lines as the Hagen, fully described in *No. 97*, page 162. A photograph of the reconstructed Hagen faces this page.

GREAT BRITAIN.

Naval Estimates for 1901-1902.—The total amount of the estimates is £30,875,500 (£1 = $4.8665), an increase of £2,083,600 over the estimates for the preceding year. The Manning Vote (Vote 1) shows an increase of £233,000, due in the main to the increased number of men last year and this year. Vote 8, shipbuilding, etc., shows a net increase of £1,274,900. Vote 9, armaments, is increased by £161,800. Vote 10, works, is increased by £137,300. The remaining Votes show a net increase of £276,600. The comparison in each case is with the original estimates of 1900-1901 plus the additional Estimates voted in July, 1900.

The total number of officers, seamen, and boys, coast guard, and

GERMAN COAST-DEFENCE SHIP HAGEN, AFTER REBUILDING.
From a photograph by A. Renard, Kiel.

marines proposed for the year 1901-1902 is 118,635, being an increase of 3745, as follows: 287 officers, 1150 seamen, 500 stokers, 398 miscellaneous, 310 artisans (including 100 electricians), 1000 marines, 100 apprentices (shipwrights and coopers).

During the year a new arrangement has been made with nearly all the great steamship companies, by which their finest vessels are held at the disposition of the Admiralty for employment as armed cruisers when required. Under the previous agreements only the Cunard, White Star, Peninsular and Oriental, and Canadian Pacific Companies were included. To these have now been added the Orient, Royal Mail, and Pacific Companies. Eighteen of the largest and swiftest passenger steamers belonging to these companies will receive an annual subvention, and thirty steamers in addition are held at the disposition of the Admiralty without further subsidy. In the main features the new agreements will be similar to former agreements, but in some particulars modifications have been made which are based on experience.

Five submarine vessels of the type invented by Mr. Holland have been ordered, the first of which should be delivered next autumn.

It is proposed to lay down in the financial year 1901-1902 the following vessels: 3 battleships, 6 armored cruisers, 2 third-class cruisers, 10 torpedo-boat destroyers, 5 torpedo boats, 2 sloops, 5 submarine boats (ordered and work commenced in 1900). Of these, 2 battleships, 1 armored cruiser, and 2 sloops will be built in the royal dockyards, and the rest by contract.

"The total vote proposed for new construction is £9,003,256, of which £8,465,406 will be devoted to pushing forward the ships already in hand to the utmost of our power and to work on the submarine boats, and £537,850 to starting work on the additional ships to be commenced. The object aimed at in this distribution of the money is to advance the work on the many ships now under construction as far as possible towards completion, and to place the ships to be newly commenced into such a position that the utmost possible amount of work can be put into them in 1902-3."

The amount required under the naval ordnance vote is larger than the original vote for 1900-01 by £915,000. An additional estimate of £753,200 was, however, taken under this vote during the year, so the net increase over 1900-01 is £161,800. A sum of £420,000 is included in the estimate in practical completion of the policy of increasing the reserves of guns and ammunition. Provision is also included for the continuation of the issue of armor-piercing shell to the fleet. Deliveries of the new design of the 12-inch B. L. wire gun have been made, and these guns are now mounted in the battleships of the Formidable class. Some delay has occurred in the completion of the new 9.2-inch B. L. guns, as the trial of the first gun showed that a slight modification of design was necessary. Deliveries are, however, now being made, the first two guns having been mounted in the Cressy, and it is hoped that the guns for succeeding ships will be ready by the time they are required. A new gun of 7.5-inch caliber has been tried satisfactorily, and has been approved. A 5-inch B. L. gun has been converted to take the Welin breech screw, and the design has been approved. Progress is being made each year with the rearmament of the fleet with .303-inch Maxims in lieu of the older patterns of machine guns. Telescopic sights have been adopted for Q. F. guns, and the supply is proceeding. A new design of mounting for the 9.2-inch gun

usual turtleback shape, on which the armor rests all along the edges, and formed of 2-inch steel plating on the flat portion forward, while on the crown of the turtleback, the slopes and all the after flat part of the deck toward the stern, its thickness is increased to 3 inches. The second armored deck is actually the gun deck, and has a protection of 1 inch of steel all over. There is thus practically an armored cofferdam extending throughout the whole of the citadel space. The barbette towers are 12 inches thick in front and 10 inches in rear, above the belt, and 6 inches inside the belt. The hoods, or gun-houses, of the heavy guns have 10-inch slopes in front, 8-inch sides and 3-inch roofs. The forward conning-tower is 14 inches thick and has an 8-inch communication tube; the after conning-tower and tube are each 3 inches thick. In the London class the forward transverse bulkhead is done away with and the belt is to be carried forward around the stem. Instead of a short belt, 9 inches thick, with 2-inch plates up to the stem, the side armor in these ships will be 9 inches thick amidships, and taper gradually to 3 inches at the bows, the gradations being 9, 7, 5, and 3 inches. As the armor is placed over the ship's plates the belt will nowhere be much less than 4 inches thick. Internally the arrangements as to protective decks are the same. The Implacable and her two sisters have been fitted with Harvey armor; while the later vessels of the London type will have Krupp armor.

Motive power.—Twin-screw, 3-cylinder, triple-expansion engines, designed to develop 15,000 I. H. P. and give a speed of 18 knots. Twenty Belleville boilers with economizers having 37,000 square feet of heating surface. Coal supply, 900 tons at load draft; total capacity, 2200 tons.

Dimensions.—Length between perpendiculars, 400 feet; over all, 430 feet; beam, 75 feet; mean draft, 26.9 feet; displacement at this draft, 15,000 tons.

ALBION: TRIALS.—Owing to defects in her boilers this battleship has been under trial since last autumn. On her 30-hour trial at four-fifths power the results were: steam at boilers, 241 pounds; vacuum in condensers, 27 inches; revolutions, 66.1; I. H. P., 2772; speed, 11.2 knots; coal per I. H. P. per hour, 2.17 pounds; draft on trial, 26.5 feet forward and aft. On March 26, she completed her 30-hour trial at four-fifths power attaining a speed of 16.8 knots and 10,809 I. H. P. with 101.8 revolutions. The 8-hour full power trial took place March 28. With steam at boilers 257 pounds, and 13,885 I. H. P., the speed was 17.8 knots. The designed speed was 18.25 knots.

PANDORA: TRIALS.—The third-class cruiser Pandora of 2200 tons has completed her trials. On her 30-hour trial the results were: I. H. P., 3638; revolutions, 1952; speed, 16.7 knots. The 8-hour, full speed trial gave: I. H. P., 5187; revolutions, 218; speed 18.625 knots. She is the last of her class to be completed and was commenced in 1898.

TORPEDO-BOAT DESTROYERS: SEA-KEEPING QUALITIES.—The recent experiments in the British navy of sending destroyers out and keeping them at sea for weeks at a time has not added to our admiration of their sea-keeping qualities. Of the instruction flotilla which returned to Devonport about Easter time after several weeks absence—not altogether at sea by any means, but chiefly so—only four of the eight returned on time. Two had been *hors du combat* for some days and were in port repairing while the Wolf, somewhat strained herself, was delayed by having to escort the Seal, which was badly injured and narrowly escaped foundering. Several of the vessels had their decks cracked open in the heavy seas and many of the destroyers are now laid up by serious injury

to the hulls from strains received in heavy seas. The worst cases of straining and injury are in those destroyers which, like the Seal, have their engines in the center of the boat and their boilers and coal forward and abaft. The following is from a British paper:

The attempt at running the instructional destroyers away from the port for three weeks at a time, and returning to lie up for one week, has not been very successful. Never during any of the three cruises have the eight boats cruised in company, and at the conclusion of each trip one or more boats have had to pay off. At the present rate of consumption, the reserve supply of boats will not be sufficient to keep the flotilla as a squadron in being at this port. The same difficulty is being experienced at the other ports in keeping the flotillas' numbers up to an establishment of eight.

For vessels of this type to be knocking about the Channel and Irish Sea in weather which causes most other vessels to look for shelter, seems to be the height of absurdity. Nothing is gained by it, no evolution can be carried out, and nothing can be done except steam at a very slow speed and hold on as well as possible. That the boats are perfectly safe and seaworthy everyone who has been in one in bad weather admits; that is, if—and here comes the point—if they do not strain themselves. But that is just what happens.

The most serious case is that of the Seal, which has broken her back, and it is feared she will not again be fit for service—a most unfortunate ending for a comparatively new vessel, which has cost the country about £75,000. She was simply struck by an enormous wave last Tuesday afternoon, when in the Bristol Channel, on her way from Birkenhead to Devonport. The shock was terrific, and those below deck at first thought that she had crashed at full speed into a large vessel or other obstruction. Those on deck, however, feared what had happened, and their fears were realized when they discovered that the upper deck was cracked across over the foremost bunker sufficient to let daylight into the stokehold, and the side plates were split down to a depth of eighteen inches. Assistance was at once signalled for, and in response the second division of the flotilla was instructed to escort the Seal into St. Ives. Here a temporary repair was effected, and, waiting for a break in the continuous bad weather, the Seal, under convoy of the Wolf, made her way to Plymouth.—*Journal of American Society of Naval Engineers* and British papers.

KANGAROO AND MYRMIDON: TRIALS.—These torpedo-boat destroyers have completed their trials with the following results:

	Kangaroo.	Myrmidon.
Speed for 3 hours	30.03	30.229
Revolutions per minute	378.8	379.2
I. H. P.	6463	6303
Air-pressure	2.7	2.8

The weather was heavy during the trial of the Kangaroo. These vessels are sister ships to the Syren described in the PROCEEDINGS for March, page 170.

LIVELY: TRIALS.—The torpedo-boat destroyer Lively, built by Laird, of Birkenhead, has completed her trials. The mean results of six runs over the measured mile were: steam, 229.5 pounds; I. H. P., 6354; speed, 30.19 knots. The mean speed for the three hours was 30.278 knots.

SUBMARINE BOATS.—The British government has decided to build five boats of the Holland type, the general features of which are practically identical with those now under construction for our government. The following description of the British boats is chiefly from "Engineering."

The dimensions are: Length, 63 feet 4 inches over all; 11 feet 9 inches beam, and 120 tons displacement when submerged. The boats will be provided with means of expelling torpedoes either with the boat stationary, during a run on the surface, or steaming at any speed submerged. The armament consists of one torpedo-expulsion tube at the extreme forward end of the vessel, the muzzle covering opening outward two feet below the light water-line. Interlocking safety devices are employed to prevent accident while operating valves for the expulsion of the torpedo.

The general construction of the vessels is such that all portions of the exterior of the hull are free from projections of a nature to be entangled by ropes or other obstacles when submerged, and the lines of the hull are specially designed to minimize resistance for surface cruising. The plating and frames are to be of steel of sufficient size and thickness to withstand the pressures of depths not over 100 feet. The seams are designed to give high efficiency to the joints. The bulkheads are located not only to ensure safety in the event of collision, but to stiffen the hull as a whole. Decks are to be provided throughout the entire length of the interior of the vessel, combined with beams and floors to carry the weight of the machinery. The tanks are to be of steel, braced and stiffened according to the requirements, and riveted and caulked absolutely tight. Manholes will be located to allow access to the interiors of all the tanks.

The superstructure is to be located to allow of an above-water deck when the vessel is light for surface running, also to have means of stowing anchor and lines and to afford mooring facilities to the vessel. A deck, 31 feet long, will be provided for use on such occasions.

The rudders are of steel plates, supported by skegs at the stern. As shall presently be explained, the vessel dives like a porpoise instead of sinking on an even keel, and for this purpose there are horizontal as well as vertical rudders.

The conning-tower is of steel armor, the outside diameter being 32 inches and the minimum thickness 4 inches, with ports for observation by the navigator.

The propulsion of the vessel on the surface is effected by an Otto engine of the gasoline type.

An electric motor of the water-proof type is provided for giving the vessel a speed of 7 knots when submerged, and is worked by storage batteries having a capacity which will admit of a four hours' submerged run at 7 knots. Gearing is provided to allow for the charging of the battery, for driving the propeller from the main engine, or moving the engine from the main motor, the combinations being effected through clutches, which are operated as desired. Switches, etc., are provided for the safe and efficient distribution of the electric current throughout the vessel. The lighting of the boat is effected by portable incandescent electric lamps, while there are several ports and openings in the hull to admit daylight.

The ballasting system consists of apparatus for quickly changing the vessel from light to a diving condition, and for keeping her displacement constant in different waters—*i. e.* in salt or fresh water. The same ar-

rangement is utilized for enabling the navigator to adjust the longitudinal trim when diving, or for compensating for the variable weights installed or expended from time to time, such as discharging torpedoes, etc. The air supply and ventilation are secured by compressed air stored on board the vessel, the gasoline vapors from the engine being carefully excluded by ingenious arrangements. Safety valves are arranged to relieve any excess of pressure in the vessel over that of the atmosphere.

Steering and diving engines are provided, and are fitted with automatic means of moving the rudders to the desired positions to prevent the vessel from inclining to excessive angles during diving or rising, and to keep the depth of submergence constant, as well also as to bring the vessel to a horizontal position at the required depth, and to prevent diving to excessive depths. In addition to these mechanical means, steering and diving can be executed by hand gear if desired. The compasses carried on board the vessel are compensated and adjusted so that the boat can be steered with equal accuracy when submerged as on the surface.

The general operation of the boat may thus be briefly described: Before it is desired to make a dive, the boat is brought to an "awash" condition, with only the conning-tower ports above the water. The dive is then made at a small angle until the proper depth is reached, when, by automatic means, the boat is brought to a horizontal position. After the discharge of the torpedo from the fixed bow tube the compensation for the weight of the torpedo is made automatically, causing only a slight change of trim for a few seconds. Provision is made for quick rising and diving, the time of appearance of the conning-tower above water being dependent upon the skill of the navigator.

The official trial will be a surface run of ten miles at a speed of 7 knots, and a submerged run of two miles at a speed of 7 knots. At the end of this last run a service torpedo will be fired at a target 150 feet long by 16 feet deep, the upper edge being awash and at right angles to the course. During the submerged run the boats must not come to the surface more than three times from the time of starting until the discharge of the torpedo, and the duration of each appearance must not exceed one minute. Suitable masts are provided for observing the movements of the boat while submerged.

GREECE.

NEW PROGRAM.—It is reported that the navy department is going to order abroad the construction of two cruisers, two torpedo-boat destroyers and six torpedo boats. A reorganization of the navy is also under consideration.

ITALY.

BUDGET FOR 1902.—The budget for 1902 has not yet been approved by the Italian parliament. As the views in regard to it are very diverse the outcome cannot be foreseen. It is therefore useless to enumerate the various proposals, many of which are likely to be rejected.

AMMIRAGLIO DI ST. BON, EMANUELE FILIBERTO: TRIALS, DESCRIPTION.—The official trials of the Emanuele Filiberto gave the following results:

	Natural draft.	Forced draft.
Duration of trial, hours	6	1.5
Mean draft, feet	24.51	24.64
Displacement, tons	9660	9740
Steam pressure in boilers	150	145
Steam pressure at engines	146	143
Air pressure in ash pits, inches	...	1 to 1.2
Revolutions per minute	94	97.7
I. H. P., mean	9526	13,442
Speed, knots	16.8	15.71
Slip, per cent	9.35	18.42
Days elapsed since last docking	80	177

The low speed on the forced draft trial is ascribed to the foul condition of the ship's bottom, due to lying in port nearly six months after the bottom was cleaned.

The results of the natural draft trial of the St. Bon were: steam pressure at boilers, 134 pounds; I. H. P., 9734; revolutions, 93.5; speed, 17.5 knots. Recent forced draft trials, which are stated to be only preliminary, gave a speed of 19.2 knots with 104 revolutions.

These battleships have been under construction for six years and were launched as long ago as 1897. They were the first of a new type which has received many variations, for it may in some measure be regarded as the progenitor of the Colon and Garibaldi, though at first glance the differences are very considerable. These battleships do not at all resemble the plans generally published in the various annuals, being long and low. The freeboard at the bow is possibly 15 feet—amidships and aft probably not much over 10 feet. The hull is of steel without sheathing. There are two smokepipes, spaced wide apart in opposite ends of the superstructure with a military mast carrying two tops and a very high topmast between them. The complement is 600 officers and men; and the principal details are:

Armament.—Four 10-inch guns in turrets over barbette towers which rise eight or nine feet above the main deck and give a very unusual appearance to the ship. Eight 6-inch guns: one each side in the ends of the armored redoubt which rises amidships above the main deck in the form of a superstructure; outboard of these guns the superstructure is cut away so that the other pairs of 6-inch guns can fire directly ahead or astern according to their position. Two 2.9-inch guns. Eight 6-pounders. Nineteen 1-pounders. Four submerged torpedo tubes.

Protection.—Complete nickel-steel belt, 9.8 inches thick amidships and 3.9 inches at the ends. Barbette towers, 9.8 inches. Turrets, 5.9 inches. Armored superstructure enclosing 6-inch battery, 5.9 inches. Conning-tower, 5.9 inches. Protective deck, 3.1 to 1.5 inches.

Motive power.—Twin-screw, vertical, triple-expansion engines, designed to develop 13,500 I. H. P. and give a speed of 18 knots. Twelve 3-furnace cylindrical boilers. Coal supply, 600 tons; total capacity, 1000 tons; also liquid fuel in double bottoms.

Dimensions.—Length, 344.5 feet; beam, 69.3 feet; mean draft, 24.75 feet; displacement, as designed, 9800 tons. Owing to changes introduced in building, the displacement at normal draft with 600 tons of coal is considerably increased.

AGORDAT: TRIAL.—This torpedo cruiser has recently completed her trials with the following results:

Date of Trial	Feb. 11	Mar. 6
Draft, mean, feet	9.77	10
Displacement, tons	1200	1246
Days since last docking	120	150
Duration of trial, hours	3	6
Steam at boilers	203	169
Steam at engines	169	155
Air pressure, inches	0.47	2.2 to 3.0
Revolutions	232	190
Mean I. H. P.	8550	4670
Mean speed, knots	22.2	18.8
Slip of screw, per cent	12.6	9.5
Coal per I. H. P.	——	2.04

During the full power trial the speed at times exceeded 23 knots.

The Agordat and her sister ship the Coatit have been under construction since 1896. The hull is of steel without sheathing. The complement is 150 officers and men. The principal details are:

Armament.—Twelve 12-pounders. Eight 6-pounders. Two 1-pounders. Two torpedo tubes.

Protection.—Protective deck, 0.75-inch thick. Cofferdams.

Motive power.—Twin-screw, triple-expansion engines, designed to develop 7500 I. H. P. and give a speed of 23 knots. Eight Blechynden water-tube boilers.

Dimensions.—Length, between perpendiculars, 287.4 feet; beam, 30.6 feet; mean draft, 10.33 feet; displacement, 1313 tons.

OSTRO: LAUNCH, DESCRIPTION.—The torpedo-boat destroyer Ostro was launched at the yard of F. Schichau, Elbing, Prussia, February 9, 1901. She is one of six ordered of Herr Schichau, two of which are completed, the Lampo and Freccia; and three others, the Dardo, Euro, and Strale, were ready for trial some time since. The principal details are:

Armament.—One 12-pounder; five 6-pounders; two torpedo tubes.

Motive power.—Twin-screw, triple-expansion engines, designed to develop 6000 I. H. P. and give a speed of 30 knots. Coal capacity, 60 tons.

Dimensions.—Length between perpendiculars, 198.6 feet; beam, 21.32 feet; draft, forward 5.74 feet; draft, aft, 8.36 feet; displacement, 320 tons.

DELFINO: DESCRIPTION AND EXPERIMENTS.—It is reported that the Italian submarine boat Delfino is to be prepared for further experiments in submarine navigation. This boat was designed by the late Signor Pullino, Italian naval constructor, and was completed in 1896. The hull is fusiform, or cigar-shaped, and built of steel 30 (?) millimeters (1.2 inches) thick. The length is 78.7 feet; beam and depth, 9.5 feet; displacement when totally submerged, about 107 tons. Power is obtained from an accumulator battery of 300 elements supplying an electric motor driving a single screw. Two smaller screws are used to facilitate diving and rising. Steadiness and preservation of immersion at a constant depth are obtained by two side rudders or "ailettes," while the steering is effected by rudders at each end of the boat. The armament consists of two torpedo tubes in the bow. The air supply is based upon that necessary for twelve men during 7 or 8 hours, which is the time endurance of the accumulators at the ordinary speed. Many changes have been made in the Delfino since her first trials, but of late not much has been done with her. Her cost was about $60,000.

JAPAN.

BUDGET FOR 1901-1902.—The naval budget for the fiscal year April 1, 1901, to March 31, 1902, includes:

1. Ordinary expenses	42,522,517	marks (1 mark = $0.238).
2. Extraordinary expenses	37,971,377	"
3. First instalment for commencing steel and armor plate works for the navy at Kuré	2,272,521	"
Total	82,766,415	"

The same items for the preceding year amounted to 85,938,400 marks. The total cost of the armor plate and steel works is placed at 13,314,000 marks and the time to complete is estimated at five years.

The total cost of the naval establishment foots up to 105,231,000 marks. Among the items of the budget the following are interesting:

For new construction, ships building and projected	19,809,300	marks.
For torpedo boats and destroyers	9,030,000	"
For armament	8,941,800	"
For improvement of naval ports	3,387,000	"

The following ships now under construction will be completed during the year: Battleship Mikasa, 15,360 tons; armored cruiser Iwate, 9900 tons; torpedo cruiser Chihaya, 1250 tons. The construction of the following vessels will be continued or commenced during the year:

Two protected cruisers at Yokosuka dockyard, the Niikata and Tsushima. Their dimensions are: Length, 334.6 feet; beam, 43.96 feet; draft, 16 feet; displacement, 3420 tons. The I. H. P. of the machinery will be 9400 and the speed 20 knots.

The following torpedo craft are building:

Name.	Displacement (tons).	Where building.
Destroyers.		
Shirakuma	381	Thorneycroft, Chiswick.
Asashio	381	" "
Kasumi	381	Yarrow, Poplar.
Akatsuki	381	" "
Harusame	381	Yokosuka dockyard, Japan.
Murasame	381	" " "
Hayatori	381	" " "
Asagiri	381	" " "
Torpedo boats.		
Kari	152	Kuré dockyard, Japan.
Aotaka	152	" "
Hato	152	" "
Tsubame	152	" "
Hibari	152	" "
Kiji	152	" "

—*Marine Rundschau.*

NETHERLANDS.

OPHIR, PANGRANGO, RINDJANI: LAUNCH, TRIALS, DESCRIPTION.—These three boats are alike in all essential respects and were built, or are building, at the yard of Messrs. Yarrow & Company, Poplar, where the

Ophir was launched March 6, the Pangrango April 17, and where the Rindjani is still on the ways. The two first-named boats are complete and have had their trials with the following results:

The trial of the Ophir, with a load of 30 tons, which is her normal condition as designed, attained a mean speed of 25.3 knots for three hours with forced draft, air pressure 1.5 inches.

The Pangrango, tried April 30, did a little better, averaging 25.99 knots under the same conditions of load for three hours with the same air pressure.

After the completion of the acceptance trials experiments were made to test Holden's system of burning oil to supplement coal. A first trial was made with coal only and a speed of 24.5 knots obtained over a long distance run. Then the oil-burners were started, the coal burning being continued without change of amount supplied to the furnaces. With the oil and coal together the speed was immediately increased to 26.5 knots. The coal burned throughout the trial was at the rate of 2800 pounds per hour and after the oil was introduced the consumption of this was 700 pounds per hour (Borneo oil). In the Ophir there are two boilers of equal size, and a further trial was made at a slower speed with oil only, using one boiler, when a speed of 14 knots was readily obtained, burning 500 pounds of oil per hour.

NORWAY.

SUBMARINE BOATS.—The Norwegian navy department has decided to build submarine boats for coast defence. Admiral Borresen, chief of the general staff of the navy, has submitted to the Storthing a request for a supplementary credit of $170,000 for the construction of a boat of the Holland type, which is to have a speed of 9 knots, when running on the surface, and 7 knots when submerged. This is the first of a flotilla of six of this class which it is desired to complete in two years. Admiral Borresen believes that a fleet of twenty of such boats would suffice to protect Christiania and the southwest coast of Norway against all hostile attempts.

UNITED STATES.

CONDITION OF VESSELS UNDER CONSTRUCTION.

No.	Name.	Where building.	Per cent. completed. June 1.	May 1.
	Battleships.			
7.	Illinois	Newport News.	94	92
10.	Maine	Cramp, Phila.	52	50
11.	Missouri	Newport News.	37	32
12.	Ohio	Union Iron Works, S. F.	53	42
13.	Virginia	Newport News.	0	0
14.	Nebraska	Moran Bros., Seattle.	0	0
15.	Georgia	Bath Iron Works, Me.	0	0
16.	New Jersey	Fore River Co., Mass.	0	0
17.	Rhode Island	" "	0	0
	Armored Cruisers.			
4.	Pennsylvania	Cramp, Phila.	0	0
5.	West Virginia	Newport News.	0	0
6.	California	Union Iron Works, S. F.	0	0
7.	Colorado	Cramp, Phila.	0	0
8.	Maryland	Newport News.	0	0
9.	South Dakota	Union Iron Works.	0	0

CONDITION OF VESSELS UNDER CONSTRUCTION—*Continued.*

No.	Name.	Where building.	Per cent. completed June 1.	May 1.
	Protected Cruisers.			
14.	Denver	Neafie & Levy, Phila.	47	45
15.	Des Moines	Fore River Co., Mass.	34	28
16.	Chattanooga	Nixon, Elizabethport, N. J.	32	29
17.	Galveston	Trigg Co., Richmond.	27	22
18.	Tacoma	Union Iron Works, S. F.	20	18
19.	Cleveland	Bath Iron Works, Me.	55	55
20.	St. Louis	Neafie & Levy, Phila.	0	0
21.	Milwaukee	Union Iron Works.	0	0
22.	Charleston	Newport News.	0	0
	Monitors.			
7.	Arkansas	Newport News.	57	54
8.	Nevada	Bath Iron Works.	87	86
9.	Florida	Nixon, Elizabethport, N. J.	66	65
10.	Wyoming	Union Iron Works.	75	73
	Torpedo-Boat Destroyers.			
1.	Bainbridge	Neafie & Levy.	94	94
2.	Barry	" "	88	88
3.	Chauncey	" "	90	90
4.	Dale	Trigg Co., Richmond.	94	93
5.	Decatur	" "	96	95
6.	Hopkins	Harlan & Hollingsworth, Del.	75	75
7.	Hull	" "	74	74
8.	Lawrence	Fore River Co., Mass.	99	99
9.	McDonough	" "	98	98
10.	Paul Jones	Union Iron Works.	85	87
11.	Perry	" "	93	93
12.	Preble	" "	92	90
13.	Stewart	Gas Engine & Power Co., N. Y.	53	53
14.	Truxtun	Maryland Steel Co., Balto.	68	67
15.	Whipple	" "	67	67
16.	Worden	" "	67	67
	Torpedo Boats:			
19.	Stringham	Harlan & Hollingsworth, Del.	98	98
20.	Goldsborough	Wolff & Zwicker.	99	99
21.	Bailey	Gas E. & P. Co., N. Y.	100	99
24.	Bagley	Bath Iron Works.	99	99
25.	Barney	" "	99	99
26.	Biddle	" "	99	98
27.	Blakely	Geo. Lawley & Son, Mass.	98	98
28.	De Long	" "	98	98
29.	Nicholson	Nixon, Elizabethport.	89	88
30.	O'Brien	" "	92	90
31.	Shubrick	Trigg Co., Richmond.	100	99
33.	Thornton	" "	97	97
34.	Tingey	Columbian Iron Works, Balto.	68	68
35.	Wilkes	Gas E. & P. Co.	80	79
	Submarine Boats:			
1.	Plunger	Nixon, Elizabethport.	10	9
3.	Adder	" "	60	50
4.	Grampus	Union Iron Works.	51	50
5.	Moccasin	Nixon, Elizabethport.	58	40
6.	Pike	Union Iron Works.	50	50
7.	Porpoise	Nixon, Elizabethport.	55	36
8.	Shark	" "	53	35

U.S.S. "MAINE"
-1901-

ENLISTMENT OF FILIPINOS.—The Secretary of the Navy has authorized Admiral Remey to enlist as firemen, coal passers, etc., 500 Filipinos. Many have hitherto been employed on the small gunboats but were not enlisted, being engaged merely for short trips.

MILWAUKEE: CONTRACT AWARDED.—In April the contract for the building of the protected cruiser Milwaukee, 9800 tons, was awarded to the Union Iron Works of San Francisco. The contract price is $2,825,000; time to complete, thirty-six months. The ship will be built on the Department's designs.

COLORADO: KEEL LAID.—The keel of this armored cruiser was laid at the yard of the Cramp Shipbuilding & Engine Company, Philadelphia, April 26. The keel of the Pennsylvania, a sister ship, will not be laid until after the launch of the battleship Maine, which will probably take place about the time these notes go to press.

OHIO, MAINE: LAUNCH, DESCRIPTION.—These two battleships are alike in all essential respects. The Ohio is building at the Union Iron Works, San Francisco, Cal., where she was launched May 18; and the Maine is building at the yard of the Wm. Cramp Shipbuilding and Engine Company, Philadelphia, and will probably be launched before this number of the PROCEEDINGS is ready for issue. These vessels are developments of the Alabama type which they resemble in very many respects. The dimensions and coal supply are considerably increased; they have another pair of 6-inch guns; the armor is very similarly applied but is Krupp instead of Harvey; and the machinery and boilers are very much changed, water-tube boilers being fitted, and the speed increased two knots. The hull is of steel without sheathing. The freeboard is about the same as that of the Alabama and Iowa, and the masting is similar to the Alabama's. There are three smokepipes and they are on the fore and aft midship line. There are fourteen boats, including one 40-foot and one 36-foot steamer, and they are handled by four steam cranes. Hydraulic steering gear is used on the Ohio. She has four dynamo rooms and eight 32-kilowatt generating sets. There are four searchlights, two on the pilot house and two on the main mast. The keel of the Ohio was laid February 15, 1899, and her contract price was $2,885,000. The complement is 40 officers and 511 men. The principal details are:

Armament.—Four 40-caliber, 12-inch guns (M-99, muzzle velocity, 2800 f. s.) in pairs in electrically trained balanced turrets forward and aft. Sixteen 50-caliber 6-inch guns (M-99, muzzle velocity, 2900 f. s.) in casemates: five each side in a central battery on the gun deck; one each side in single casemates on the gun deck forward with fire directly ahead; two each side in double casemates on the upper deck, forward pair firing directly ahead and after pair directly astern. Six 50-caliber 3-inch guns (M-99, muzzle velocity, 3000 f. s.). Two 3-inch field guns. Eight 6-pounders. Six 1-pounders. Two Colt machine guns. Two submerged torpedo tubes. The ordinary supply of ammunition is 240 rounds of 12-inch, 3200 rounds of 6-inch, about 2400 rounds of 3-inch, 4800 rounds of 6-pounder, and 4000 rounds of 1-pounder ammunition. Additional amounts will be carried in time of war.

Protection.—Complete belt, 3.5 feet above water and 4 feet below, having a thickness of 11 inches for a depth of 4.25 feet from the upper edge and tapering to 7.5 inches at the bottom. The upper works between the main turrets are protected by side armor 6 inches thick laid over the side plating. This is closed at the ends by 9-inch diagonal bulkheads.

Forward, this bulkhead rises from the armor deck to the upper deck; aft, the ends of the belt armor are joined to the barbette towers by diagonal bulkheads of 9 inches, but the central superstructure does not extend so far aft and it is closed by a 6-inch diagonal bulkhead, the ends of each diagonal meeting just forward of the after barbette tower. The protective deck is flat amidships between the barbette towers, but forward and aft it slopes down to meet the lower edge of the belt at the sides. The thickness on the flat is 2.75 inches; on the slopes forward, 4 inches; and on the slopes aft, 3 inches. Cofferdams are built on the protective deck from the diagonal bulkheads to the bow and stem; and on the berth deck for nearly the whole length of the vessel. All cofferdams are to be filled with corn-pith cellulose. The turrets of the 12-inch guns have inclined fronts 12 inches thick and 11-inch sides. The barbette towers are 12 inches thick on the exposed sides and 8 inches in rear. There are two conning-towers, the forward one 10 inches thick with 7-inch communication tube 12 inches in inside diameter; and the after one 6 inches thick with 3-inch (?) tube.

Motive power.—The engines are twin-screw, vertical, 3-cylinder, triple-expansion, with cylinders of 38.5, 59, and 92 inches diameter and 42 inches stroke. At 126 revolutions they are expected to develop 16,000 I. H. P. and give a speed of 18 knots. The Maine will be fitted with Niclausse boilers but the Ohio with those of the Thorneycroft type. The coal supply at load draft is 1000 tons; total capacity, 2000 tons.

Dimensions.—Length on load water-line, 388 feet; beam, 72.2 feet; mean draft at normal load, 23.5 feet; normal load displacement of the Ohio, 12,440 tons; of the Maine, 12,300 tons; full load displacement of both, about 13,500 tons; tons of displacement per inch of immersion at normal draft, 52.

BAGLEY, BARNEY: TRIALS, DESCRIPTION.—These two torpedo boats have completed their trials. On May 15 the Barney made 29.1 knots for two hours instead of 28 knots as required by contract. The Bagley, a sister boat, the next day averaged 29.2 knots. The boats were both built at the Bath Iron Works from the contractors' own designs. Complement, 3 officers and 26 men. Contract price, $161,000. The principal details are:

Armament.—Three 17.7-inch torpedo tubes; three 3-pounders.

Motive power.—Twin-screw, vertical, triple-expansion engines, designed to develop 4200 I. H. P. and give a speed of 28 knots. Normand water-tube boilers.

Dimensions.—Length on water-line, 157 feet; beam, 17 feet; mean draft, 4.6 feet; maximum draft aft with full load, 8 feet; displacement, 167 tons.

BAILEY: TRIALS, DESCRIPTION.—The torpedo boat Bailey had her official trial April 25 in Long Island Sound. The mean speed for the two hours was 30.2 knots and the maximum speed attained was 31.12 knots with 418 revolutions. The Bailey was built by the Gas Engine and Power Company and Charles Seabury, Morris Heights, New York, where she was launched December 15, 1899. The complement is 3 officers and 53 men. The contract price was $210,000. The principal details are:

Armament.—Two 17.7-inch torpedo tubes; four 6-pounders.

Motive power.—Twin-screw, vertical, triple-expansion engines, designed to develop 5600 I. H. P. and give a speed of 30 knots. Seabury water-tube boilers. Normal coal supply, 20 tons; bunker capacity not reported but probably about 100 tons.

Dimensions.—Length on load water-line, 205 feet; beam, 19.2 feet; mean draft, 6 feet; maximum draft aft at full load, 7.9 feet; displacement, 235 tons; tons displacement per inch of immersion, 6.88.

PERRY: UNSATISFACTORY TRIAL, REMARKS.—The preliminary and the standardizing trials of this torpedo-boat destroyer, building by the Union Iron Works from the design of the Navy Department (described in PROCEEDINGS *No.* 97, page 190), were carried out in San Francisco Bay between the 25th of February and the 5th of April, and, in consequence of the results being so far below what was anticipated it has been determined to suspend further trials pending the construction of screws with more surface than those with which she was fitted during these trials. Should she succeed in reaching the contract speed with the new screws, the Preble, also building by the Union Iron Works, will be tried with similar ones; but should she fail, a change will be made in the shape of the stern.

As completed, she draws 14 inches more water at the stern than was contemplated in the design, and is of about 470 tons displacement instead of 430. This increase being principally in weights of the hull. Some of the trial weights were removed to improve her trim before commencing the standardizing trials. The results of these trials, made on different days, are:

Speed.	Revolutions.	I. H. P.
17.	177.8	947
19.72	212.6	1792
23.31	269.1	4005
24.17	287.2	4866
25.50	308.1	6040
27.68	333.2	7470
28.20	338.5	7752

The contract speed is 29 knots.

As a consequence of these trials, and of runs in the model tank of the model of the vessel as completed, it is probable that the sterns of the destroyers Bainbridge, Barry, and Chauncey, building by Messrs. Neafie & Levy, and of the Paul Jones, building by the Union Iron Works and yet unlaunched, will be flattened in order to reduce the resistance which the peculiar shape of the stern appears to offer.

Two other destroyers, the Dale and Decatur, building by the William R. Trigg Company, have been launched, but as the speed in their case is to be but 28 knots, it is probable that the alteration of the stern will not be made until after they have been tried.—*Journal of American Society of Naval Engineers.*

SHUBRICK, THORNTON: TRIALS, DESCRIPTION.—The Shubrick completed her official trials April 5, having made an average of 26.07 knots for two hours. Subsequent corrections and allowances for tide, etc., increase this to 26.75 knots. The trial of the Thornton on April 12 was stopped on account of the bursting of a boiler tube. These boats are alike in all respects and were built at the yard of the William R. Trigg Company, Richmond, Va., where they were launched; the Shubrick on October 31, 1899, and the Thornton on May 15, 1900. The complement is 3 officers and 26 men. The contract price was $129,750. The principal details are:

Armament.—Three tubes for 17.7-inch whitehead torpedoes; three 3-pounders.

Motive power.—Twin-screw, vertical, triple-expansion engines, designed to develop 3000 I. H. P. and give a speed of 26 knots. Thorneycroft water-tube boilers. Coal supply, 10 tons; total capacity, 70 tons.

Dimensions.—Length on water-line, 175 feet; beam, 17.5 feet; mean draft, 4.7 feet; maximum draft aft with full load, 7.5 feet; displacement, 165 tons; tons displacement per inch of immersion at load draft, 5.4.

TINGEY: LAUNCH, DESCRIPTION.—The torpedo boat Tingey was launched at the Columbian Iron Works, Baltimore, March 25. She is one of the group of twelve torpedo boats and sixteen destroyers appropriated for by Congress in 1898. She is in all respects, including boilers, a sister ship to the Shubrick and Thornton described above. The contract price was $168,000. Owing to the financial condition of the Columbian Iron Works, the Navy Department declared the contract forfeited, and was about to advertise for bids for completing her; but a new company having been formed to operate the Columbian Iron Works, the Department has decided to entrust the completion of the Tingey to this company.—*Journal of American Society of Naval Engineers.*

ILLINOIS: TRIAL SPEED.—On June 15, after these notes had been prepared and when they were about to be transmitted to the printer, it was learned that the battleship Illinois, which returned from her trial trip the day before, had made a mean speed of 17.45 knots on her four hour trial, after correcting the apparent speed of 17.31 knots for tide, etc.

AMMUNITION.

CAPPED PROJECTILES.—Mr. P. M. Staunton, late Captain of the Royal Artillery, in a letter to the editor of *Engineering* (London), presents his views on the action of the cap which are somewhat at variance with the generally accepted ideas. He has also taken out patents for projectile caps designed in accordance with his theories. Inasmuch as the absolute correctness of no theories in regard to the function of the cap have received conclusive proof, it is interesting to examine all new ones which are within the bounds of reason.

After comparing the results of the trials of various forms of caps, Mr. Staunton concludes that:

"If my views be correct, the most important functions of caps on armor-piercing projectiles are to delay 'full impact' and to distribute the shock thereof more fully over the superficial area of the projectile, thereby protecting its structure from fracture and enabling more of its kinetic energy to be expended in doing work on the armor, and it follows as a matter of demonstration that for the purpose of attacking steel armor plating with a high striking velocity, such caps shall be so made as:

"1. To further increase the distance between the point of initial impact and the point of the projectile.

"2. To increase the duration of their resistance to compression on impact.

"3. To enable them to take up a larger proportion of the initial pressure of impact before being fractured or forced back on the projectile's nose.

"4. To enable them to distribute the shock incidental to such pressure over an increased superficial area of the projectile.

"5. To provide a soft cushion which will break the disintegrating force of impact on the projectile's point.

"6. To provide a ready means whereby the projectile may force its way through and free of the cap when penetration is commencing."

The form of cap which Mr. Staunton seems to prefer is one which extends beyond the point of the projectile about one-third of a caliber, and extends as a thin envelope, of decreasing thickness, more than two-thirds the way to the base. The projectile itself is therefore slightly coned from the bourrelet to the base. The axis of the cap above the point is cored out by removing a small axial cylinder of a diameter of perhaps one-eighth a caliber, and the cavity so formed is filled with lead. The cap itself is of hard and tough steel. Upon striking the armor plate, the cap is destroyed, being split apart as the projectile advances through it. It has then, however, performed what Mr. Staunton assumes to be its chief function which is to distribute the force of the blow over the mass of the projectile—instead of allowing it all to be received on the point—without sensibly diminishing the work done upon the plate. Incidentally, of course, the cap does support the point against fracture until it is fairly entered into the plate, though not to the same extent as a closer-fitting cap of soft steel.

SHRAPNEL: NEW GERMAN MODEL.—A new design of shrapnel is patented by the Rheinische Metallwaaren und Maschinfabrik (Germany). The novelty consists in longitudinal ribs extending along the inner surface of the shell. Two objects are expected to be secured by this design. First, the shell is strengthened without sensibly increasing the weight or capacity; and second, the rotary displacement of the balls is prevented. The balls themselves are provided with flats so that they may be packed firmly within the shell, one above the other, and thus prevent wedging.

SHELL AND SHRAPNEL: BRITISH SHELL AND SHRAPNEL IN SOUTH AFRICA.—According to Herr Gentz, a Prussian officer who was in the Boer service, the British artillery practice in South Africa was very good but many of the British shrapnel and shell did not burst at all and few if any of the shrapnel burst effectively, the case not breaking up as it should so that the dispersion of shell fragments and balls was very slight. From other sources it is learned that the lyddite shells for the field guns were a disappointment. The explosion was usually one of low order, showing greenish fumes instead of the blackish ones of detonation. The British technical papers say that lyddite is not a success in calibers below four inches and not fully successful in shells of less than six-inch caliber. Whether the small shells rupture before the proper temperature and pressure are reached, or whether small amounts of the explosive do not develop the requisite temperature with sufficient rapidity for detonation is not stated.

GAS-CHECKS FOR PROJECTILES.—Many persons still hold to the opinion that erosion of the bore is due to the escape of gas past the projectile. Either because of holding this view, or because probable purchases of ammunition do, Sir Hiram Maxim has brought out an improvement of his base-ring gas-check for projectiles. In the present model a movable metal ring, at the moment of firing, presses a semi-plastic ring out against the surface of the bore. As the projectile moves along the bore

the movable ring acts as a plunger and causes a quantity of fatty material, contained in a cavity in the projectile, to be continuously supplied to the semi-plastic ring.

SPECIAL POWDER CASE TO REDUCE EROSION.—Of all the means taken to cure the erosive qualities of nitroglycerin powders such as cordite, the most astonishing is that which is made the subject of a patent by Sir A. Noble. He considers that the erosion of guns is mainly due to the excessive heat developed in the combustion of the nitroglycerin powders. (This is like saying that a man who is hung dies of heart failure.) In order to decrease the temperature without diminishing the ballistic effect a water case is placed in front of the charge and it is expected that the expansion of the vaporized water will more or less compensate for the loss occasioned by the decreased temperature of the gunpowder gases.

POWDER BAGS WOVEN FROM SMOKELESS POWDER THREADS.—Krupp has taken out three or more patents, differing but little in general character, covering processes of making the envelope or bag for the powder charge of a fabric woven from strands or threads of smokeless powder. It is hoped in this way to prevent the collection of any residue in the bore.

PRIMERS: NEW U. S. NAVY COMBINATION PRIMERS.—The new combination electric and percussion primer is now being issued to the service for all guns having primer seats in the mushroom stalk fitted for their use. The new primer differs from the old ones both in size and shape. It is about the size of a 32-cal. revolver cartridge shell but three or four times as long.

FUSES.—Krupp has patented an improvement on his well-known fuse which has an adjustable time ring like our own Navy fuze (Sweet's). The improvement consists in better means for jamming and holding the ring in the position in which it is set. It would seem from this that the fuse has given trouble in this respect. A new time fuse is the combined invention of Lieutenant A. T. Dawson (late R. N.—now of Sir W. T. Armstrong, Whitworth & Company), G. T. Buckham, and S. V. Dardier. It is a combination time and percussion fuse but the description is inadequate to give a correct understanding of the mechanism. The ignition is caused by a pellet which flies to the rear to fire the time train and another pellet which flies forward and strikes a cap when the projectile is suddenly checked or stopped.

ARMOR.

TRIAL OF A 6-INCH ARMSTRONG, SPECIAL PROCESS, NICKEL-STEEL PLATE.—The trial took place February 7, 1901, at Whale Island, Portsmouth, and was incompletely reported in PROCEEDINGS *No.* 97, page 194. Plate: 8 feet by 6 feet by 6 inches; secured by eight bolts to a backing 3.8 feet thick. The gun used in all five rounds was a 6-inch, British service type. The projectiles were all Holtzer armor-piercing, apparently from an old lot made many years ago. In this connection see letter from the Holtzer Works appended to the trial data. The results of the trial were as follows:

Round.	Weight of Projectile (lbs.)	Striking Velocity. (f.s.)	Striking Energy. (f.t.)	Point of Impact.	Effect on Plate.	Effect on Projectile.
1	100.5	1997	2779	2 ft. from right edge and 2 ft. from bottom.	Point of shot imbedded, but was shaken out by round 4; penetration then found to be 2.3 inches; inner area of damage, 12 by 10 inches; face flaked off, 16 by 18 inches; no cracks. Surface shaken at under side and flaked off further at round 2. Rear of plate slightly bulged; crack formed part way around bulge.	Projectile broken up.
2	100.0	2016	2818	2 ft. from left edge and 2 ft. from bottom.	Point of shot embedded, but shaken out by round 4; penetration then found to be 2.7 inches; inner area of damage, 12 by 12 inches; face flaked off 23 by 21 inches; no cracks. This round increased the flaking at round 1, and at round 3 the flaking of this round was increased: Marked bulge in rear of plate; crack extending nearly all around it.	Projectile broken up.
3	100.5	1974	2717	2 ft. from left edge and 2 ft. from top.	Point of shot embedded. After point of shot was shaken out, the penetration was found to be 1.6 to 1.7 inches; face flaked off 15 by 12 inches; flaking around impact 2 increased; no cracks. Faint bulge on rear of plate behind point of impact, no cracks.	Projectile broken up.
4	101.0	1975	2732	2 ft. from right edge and 2 ft. from top.	Point of shot imbedded, but shaken out by round 5; penetration then found to be 1.5 inches; face flaked off, 22.5 by 20.5 inches; a crack now showed from right hand edge of round 1 to right hand edge of plate, depth not ascertained. Further flaking at round 3. Bulge in rear of plate not perceptible in the photograph and is uncracked.	Projectile broken up.
5	100.0	1986	2735	Center of plate.	Point of shot imbedded. As the point of the shot remained imbedded, the full depth of the penetration could not be measured. As the back bulge was much higher than that of any other shot, the penetration was probably over 3 inches. The back bulge was cracked nearly all around. The flaking was 23 inches wide abreast the point of impact, but vertically the whole face was flaked off between this and the points of impact of the preceding shots; and there was further flaking above points 3 and 4.	Projectile broken up.

The first four rounds constituted the government test. The fifth round was made at the suggestion of the representative of the makers. The details of this trial are derived from the London *Engineer* and appeared in the issue of April 12, 1901. In the issue of April 19 there appeared the following letter:

OPENSHAW ARMOR PLATE.

MESSIEURS.—Veuillez nous permettre de vous presenter, au sujet de l'essai de plaque relaté dans l'ENGINEER du 12 courant, page 377, l'observation suivante.

Sans contester l'excellence de la plaque d'Openshaw Works, essayée le 21 Fevrier dernier avec des obus de 6 pouces Holtzer, il nous semble qu'il eut été correct d'indiquer aussi l'age de ces projectiles, car il y a douze ans au moins qu'ils ont été fabriqués; à une époque où les plaques à face cémentée et rempié, genre Harvey, n'étaient pas encore inventées.

Or les perfectionnements de nos projectiles, ayant suivi de près, ceux qui ont été apportés aux plaques, il en résulte que des essais, comme celui que nous reproduisez, ne peuvent qu'induire en erreur vos lecteurs, sur la situation vraie et actuelle des choses, si ils ne sont pas accompagnés de l'observation que nous avons l'honneur de soumettre.

Veuillez agréer, M. Messieurs, l'assurance de notre consideration distinguée.

P. MM. JACOB HOLTZER ET CIE.
(H. A. BRUSTLEIN.)

Aciéries et Unieux (Loire) le 15 Avril.

[It is to be remarked that there is no reflection on the quality of the plate in the above letter. The plate was tested and accepted officially, so that its efficiency is not in question. At the same time it may be interesting to know, accepting Messrs. Holtzer's statement, why modern projectiles are not used against modern armor?—ED. THE E.]

TRIAL OF A 4-INCH ARMSTRONG NICKEL-STEEL PLATE, NOT FACE-HARDENED.—This trial took place April 7. The plate was intended for the armored cruiser Lancaster or one of her sisters. Three shots were fired from a 4.7-inch gun. The shells weighed 45 pounds, and were armor-piercing; maker not reported. The initial velocity was 1630 f. s. and the maximum penetration was 1 inch. The compiler hopes to present fuller details of these trials.

EDDYSTONE ARMOR PLANT.—A large armor plant is now in process of erection at Eddystone, near Philadelphia. It is to be called the Gruson Iron Works and is said to be a branch of the Grusonwerke, Magdeburg-Buckau, Germany, which was developed by Herr Gruson but was sold some years since to Herr Krupp, and is now owned and operated by him. The new works will be prepared to furnish chilled armor in the form of turrets and casemates for coast defense. The construction of these works is said to have been brought about by the reported intention of the Board on Fortification to use turrets and barbettes for coast defence in place of disappearing mounts.

BOILERS.

REPORT OF BRITISH BOILER COMMITTEE.—The British Naval Boiler Committee, consisting of eminent naval and civilian engineers and other eminent persons, appointed by Parliament to examine into the question of water-tube boilers suitable for British warships, has made its report to Parliament. The conclusions arrived at are as follows:

"(1) The Committee are of opinion that the advantages of water-tube boilers for naval purposes are so great, chiefly from the military point of view, that, provided a satisfactory type of water-tube boiler be adopted, it would be more suitable for use in his Majesty's Navy than the cylindrical type of boiler.

"(2) The Committee do not consider that the Belleville boiler has any such advantage over other types of water-tube boilers as to lead them to

recommend it as the best adapted to the requirements of his Majesty's Navy.

"(3) The Committee recommend: (*a*) As regards ships which are to be ordered in the future: That Belleville boilers be not fitted in any case. (*b*) As regards ships recently ordered, for which the work done on the boilers is not too far advanced: That Belleville boilers be not fitted. (*c*) As regards ships under construction, for which the work is so far advanced that any alteration of type of boiler would delay the completion of the ships: That Belleville boilers be retained. (*d*) As regards completed ships: That Belleville boilers be retained as fitted.

"(4) In addition to the Belleville type of boiler, the Committee have had under consideration four types of large straight tube boilers which have been tried in war vessels, and are now being adopted on an extended scale in foreign Navies. These are: (*a*) The Babcock and Wilcox boiler; (*b*) the Niclausse boiler; (*c*) the Dürr boiler; (*d*) the Yarrow large tube boiler. (*a*) and (*b*) have also been tried in our own Navy with satisfactory results, and are now being adopted on a limited scale. If a type of water-tube boiler has to be decided on at once for use in the Navy, the Committee suggest that some or all of these types be taken.

"(5) The Committee recommend that the completion of the two sloops and the second-class cruiser fitting with Babcock and Wilcox boilers, and the sloop and first-class cruiser fitting with Niclausse boilers, be expedited, in order that the value of these types of boilers for naval purposes may be ascertained at the earliest possible date. This is especially important, as the Babcock and Wilcox boiler adopted in the ships under construction differs materially from the Babcock and Wilcox boiler as fitted in the Sheldrake.

"(6) The Committee recommend that boilers of the Dürr and of a modified Yarrow type be made and tested at the earliest possible date, under their supervision, with the view of aiding the selection of one or more types of water-tube boilers for use in his Majesty's ships."

The Committee's reasons for preferring water-tube boilers, if a suitable type can be found, are as follows:

(*a*) Rapidity of raising steam and of increasing the number of boilers at work.

(*b*) Reduction to a minimum of danger to the ship from damage to boilers from shot or shell.

(*c*) Possibility of removing damaged boilers and replacing them by new boilers in a very short time, and without opening up the decks or removing fixtures of the hull. These requirements are met by the water-tube boiler in a greater degree than by the cylindrical boiler, and are considered by the Committee of such importance as to outweigh the advantages of the latter type in economy of fuel and cost of upkeep.

Their objections to Belleville boilers are given as follows:

(*a*) The circulation of water is defective and uncertain, because of the resistance offered by the great length of tube between the feed and steam collectors, the friction of the junction boxes, and the small holes in the nipples between the feed collector and the generator tubes, which also are liable to be obstructed, and may thus become a source of danger.

(*b*) The necessity of an automatic feeding apparatus of a delicate and complicated kind.

(*c*) The great excess of the pressure required in the feed pipes and pumps over the boiler pressure.

(*d*) The considerable necessary excess of boiler pressure over the working pressure at the engines.

(*e*) The water gauges not indicating with certainty the amount of water in the boiler. This has led to serious results.

(*f*) The quantity of water which the boiler contains at different rates of combustion varying, although the same level may be shown on the water gauges.

(*g*) The necessity of providing separators with automatic blowout valves on the main steam pipes to provide for water thrown out of the boilers when speed is suddenly increased.

(*h*) The constant trouble and loss of water resulting from the nickel sleeve joints connecting the elements to the feed collectors.

(*i*) The liability of the upper generator tubes to fail by pitting or corrosion, and, in economizer boilers, the still greater liability of the economizer tubes to fail from the same cause.

Further:

(*k*) The upkeep of the Belleville boiler has so far proved to be more costly than that of cylindrical boilers; in the opinion of the Committee this excess is likely to increase materially with the age of the boilers.

(*l*) The additional evaporating plant required with Belleville boilers, and their greater coal consumption on ordinary service as compared with cylindrical boilers.

The Committee recommends that boilers of the Dürr, and of a modified Yarrow type, be made and tested at the earliest possible date. The Committee also recommends the careful trial of the vessels now being fitted with the Babcock and Wilcox and Niclausse types.

COAST DEFENSE.

UNITED STATES: APPROPRIATIONS FOR FORTIFICATIONS.—The following appropriations and provisos are contained in the Fortifications Appropriation bill which became a law March 1, 1901: Gun batteries, $1,615,000; searchlights for New York Harbor, $150,000; range and position finders, $150,000; land for fortifications and coast defenses, $200,000; protection, etc., of fortification, $100,000; fortifications, Galveston, Texas, $992,000; plans for fortifications, $5,000; tools, etc., to be furnished by the Eng. Dept. for the use of troops, $25,000; sea walls and embankments, $100,000; submarine mines and necessary appliances for our principal seaports, including San Juan, Porto Rico, $50,000; steel for seacoast guns, price not to exceed 21 cents per pound, $476,000, provided that in the discretion of the Secretary of War a portion of this money may be used for the purchase of material for steel-wire seacoast guns; carriages for mounting seacoast guns, $485,000; reserve projectiles and explosives, $600,000; rapid-fire guns, $477,908; carriages for 12-inch breech-loading mortars, $71,000; 8-, 10- and 12-inch guns, $414,536; proof of guns, $12,100; proof of seacoast mortars, $5,000; armor plates and deck plates for testing projectiles, $24,000; ammunition for artillery practice, $117,000; armament chests, $7,300; machine guns, $50,000; range finders, etc., $35,000.

Implements and equipments for service, and also for mounting, repairs, care and preservation of armament and of range finders, including $25,000 for care, repair, and preservation of fortifications in the harbor of Galveston, Texas, $50,000; material, tools and implements for battery mechanics,

$92,680; mountain guns, $77,000; rifles, siege, 5-inch B. L., $18,880; carriages for same, $26,990; sights for cannon, $23,000; fuses and primers, $25,000; ammunition of all kinds, $300,000; inspecting instruments, $5,000; subcaliber tubes, fittings and ammunition for seacoast artillery practice, $212,000.

Proving ground, Sandy Hook, N. J., $99,067; Watervliet Arsenal, West Troy, N. Y., for completing repairs and alterations on gun shops, including new cornice, $10,000; gallery drive, $12,000.

The Board of Ordnance and Fortification, $100,000; "One additional member shall be added to the said Board of Ordnance and Fortifications, who shall be an artillery officer of technical ability and experience, to be selected by the Secretary of Wa-:

"Provided, That before any money shall be expended in the construction or test of any gun, gun carriage, ammunition, or implements under the supervision of the said board, the board shall be satisfied, after due inquiry, that the Government of the United States has a lawful right to use the inventions involved in the construction of such gun, gun carriage, ammunition, or implements, or that the construction or test is made at the request of a person either having such lawful right or authorized to convey the same to the Government.

"To enable the Secretary of War to make a comparative test of destructive energy between the Gathmann torpedo gun now at Sandy Hook and the Army twelve-inch service rifle, such tests to be made against two similar targets representing the side construction of the latest type of battleship; each of said structures to be faced with Kruppized armor plate eight feet by sixteen, and twelve inches thick, and at least ten shots to be fired from the Army rifle against one structure and one or more Gathmann torpedoes against the other; for the erection of the structures and the purchase of materials, armor plates, ammunition, mount for the torpedo gun and other necessary expenses of such test, $50,500.

"To enable the Secretary of War, in his discretion, and if in his judgment it will be for the best interests of the Government, to purchase the U. S. Letters Patent, numbered 622,479, issued April 4, 1899, covering the Isham high-explosive shell, designed for firing high explosives and carrying the same through armor plate, invented and now owned and controlled by Willard S. Isham, and also to purchase the entire and exclusive right for the United States to manufacture and use the high explosive 'thorite,' invented and now owned and controlled by Doctor Hiram P. Tuttle, $100,000: Provided, That all formulæ, data, and facts related to said process and necessary to the successful manufacture of said 'thorite' shall be placed in the possession of the Secretary of War, and to his satisfaction, before any payment for the same shall be made: Provided further, That before any money shall be expended in the purchase of said patent the Secretary of War shall be satisfied, after full investigation, that the Government of the United States shall have a lawful right to use said patent, without the use of same being an infringement upon any prior invention, patent, or pending application for patent covering said invention or any material part thereof.

"That as material purchased under the foregoing provisions of this Act shall be of American manufacture, except in cases when, in the judgment of the Secretary of War, it is to the manifest interest of the United States to make purchases in limited quantities abroad, which material shall be admitted free of duty."

UNITED STATES: TORPEDO BOAT DEFENCE.—The Naval Torpedo Boat Board, under the presidency of Captain G. A. Converse, U. S. N., has decided to visit the various points on the Southern coast which have been mentioned as convenient and safe places for the torpedo stations required by the Navy Department. Among the points to be visited will be Savannah, Charleston, S. C., Port Royal, Pensacola, possibly Richmond, Va. Following the southern trip a similar investigation of northern locations will be made, and the report of the Board will indicate the advantages and disadvantages of the sites selected and recommended.—*Army & Navy Journal*, May 18, 1901.

GERMANY: COAST DEFENCE SYSTEM.—The system of Coast Defence in Germany has been most carefully worked out. No cast-iron rules covering the entire extent of the coast have been laid down but each part is treated according to the requirements of the case. The naval ports of Kiel and Wilhelmshavn, and adjacent coasts and waters, and the entrances to the Weser and Elbe, with their approaches and surroundings, are entirely controlled by the Navy. A vice-admiral is commander-in-chief of each of these four districts and of all the defences, afloat and ashore; and, by a recent imperial decree, he is given full and unlimited command within the boundaries of his district, which boundaries are carefully defined. Beyond the limits of the naval districts and in the lesser ports the general commanding the district is similarly in supreme command. This exact definition of authority cannot fail to result in harmonious working of the general defence, if the authority is wisely exercised.

COMMUNICATIONS.

NOTE.—Under this head will appear notes on Signaling, Telegraphy, Ocean Cables, Carrier Pigeons, etc.

WIRELESS TELEGRAPHY IN THE U. S. NAVY.—The Board of naval officers, headed by Captain Chadwick, appointed to make a full investigation and report on wireless telegraphy, has completed its work and submitted its report to Admiral Bradford, chief of the Naval Bureau of Equipment, having charge of this subject. It had been expected that the inquiry would last through the summer, and the Navy Department has been somewhat surprised at the promptness with which the board has been able to reach its conclusions. Although the findings are not made public, it is known that the board reports on the entire feasibility of the system, and recommends that it be adopted and that the present system of using carrier pigeons for messages between naval points be abandoned.

With the report the board submits the results of an extended conference with Senor Marconi, the Italian inventor, concerning the general subject of wireless telegraphy. It is understood that Marconi made no proposition regarding his own system, and that the board secured his views as an expert on the general subject. There is no finding in favor of any particular system, but a general treatment of all systems. The board has no doubt that wireless telegraphy will prove a valuable adjunct for the navy.—*Baltimore American*, May 8, 1901.

WIRELESS TELEGRAPHY IN THE BRITISH NAVY.—The Majestic, flagship of the Channel Squadron, had a remarkable experience in the matter of signalling by means of wireless telegraphy while on the voyage from

Portsmouth to Berehaven, where she arrived on April 22. Messages were exchanged up to a distance of 90 miles between the Majestic at sea and the Hector in Portsmouth Harbor on April 20 until at 11.45 p. m. the telegraph communication was unexpectedly suspended. The instruments on board the Majestic were then adjusted to send a message to Portland, and to the surprise of the signalling staff that station was found to be talking to the Hector, the latter explaining that it had suddenly lost touch with the Channel Squadron flagship owing to the breakdown of the apparatus key. The distance at which this information was taken was 103 miles as the crow flies, a record so far as the naval service is concerned. Probably the space thus covered would have been exceeded had not the Diadem at Plymouth interrupted, thinking that the Majestic was calling her. The achievement must be extremely gratifying to the naval officers who have worked so assiduously in the development of the system of wireless telegraphy for signalling purposes at sea, and likewise to the trained signalmen of the fleet who show an intelligent interest in the experiments and have learned to manipulate the apparatus expertly. An order has been issued in the Channel Squadron that only the flagship is to keep her wireless instruments ready for sending and receiving in harbor, the other ships disconnecting their coherers.—*United Service Gazette*, May 4, 1901.

Wireless Telegraphy in the Spanish Navy.—Wireless telegraphy is attracting considerable attention in Spain. Experiments are being made with a system invented by Colonel Cervera. With wireless telegraphy it is hoped to establish communication with the Balearic Islands and the Spanish possessions in Africa. The Marquis of Portago, director-general of communications, has asked the government for funds to carry on the experiments.

CONSTRUCTION.

Note.—Under this head will appear notes on Design, Materials, Sheathing, etc.

Tests of Fireproofed Wood.—The Assistant Secretary of the U. S. Navy has sent to the Senate the report of Assistant Naval Constructor H. G. Gillmor, U. S. N., who supervised the tests of fireproofed wood made at the Washington Navy-yard last December. The tests were made to determine whether or not wood taken from different parts of the torpedo boat Winslow had, in the five years since it was treated, lost its fireproof qualities. The wood was white pine, ash, and butternut, and four different kinds of tests were made, the stove test, hot-plate test, hot-rivet test, and splinter test. In the first, shavings and kindling wood saturated with kerosene were burned with the pieces of fireproofed wood laid on top. In the bottom of the stove was placed waste saturated with kerosene. After the shavings and kindling were entirely consumed, the fireproofed wood ceased to give off any flame or glow, and was found charred from one-eighth inch to three-sixteenth in. from the surface, but entirely sound and free from charring inside. In the hot-plate test a steel plate, 9 in. wide, 2 ft. long, and ½ in. thick, was heated until bright red on the surface, and immediately on removal from the furnace a specimen of each kind of fireproofed wood was laid on it and left so long as there was any flame from the wood. The ash specimen first ceased to give off flame, then the butternut, and the pine last. All were found

charred only on the surface, free from ash and with no tendency to glow. In the hot-rivet test rivets were heated in the furnace to a driving temperature, and laid upon the surface of the specimens. At first some flame was given off, but this soon disappeared, the charring was limited, and there was no ash where the rivets were in contact with the wood. In the last test splinters were held over the flame of a Bunsen burner burning coal gas. Flame was given off while specimens were in contact with the fire, but ceased at once when removed, and no ash formed.—*Railroad Gazette.*

FIREPROOFED WOOD IN BRITISH NAVY.—According to the *Pall Mall Gazette*, the naval authorities have decided to remove the non-inflammable wood from the new armored cruiser Cressy. Nor, says the paper, will this material be used in any other British warships. The intention of fitting it in the Kent has been abandoned, corticine-covered steel being employed instead for the 'tween-deck fittings. An oaken covering is being given to quarter-deck and forecastle, as this material is much better than bare steel for the men to get about on when at sea. But no wood is being used in places where its presence is considered dangerous. Experience has proved that where wood is bolted to steel, as it is on the upper decks of the new British ships, it will neither burn nor splinter. The British *United Service Gazette*, on the other hand, learns that "a report about the removal of non-inflammable wood in the Cressy was based upon the fact that in order to facilitate the ship being commissioned, and to avoid waiting for the drying and repainting of the non-inflammable wood, it was decided to replace some of it—a very small proportion, and principally lathing for electric wires—with ordinary wood on the upper deck only. Nothing is being removed from between decks, where the greater part of the non-inflammable wood is. We are also informed that the wood is being used on a number of the new warships under construction, and that means are being taken at the various shipyards to prevent the wood being worked into the ships whilst it is damp, this dampness, which is easily prevented, being the sole cause of any trouble experienced."—*Army & Navy Journal*, May 4, 1901.

TRIAL OF WATER-TIGHT COMPARTMENT ON THE KENT.—A trial of water-tight bulkheads, doors and fittings took place recently on board the British armored cruiser Kent which was launched on March 6. One of the main engine compartments was closed and water admitted to the estimated amount of one thousand tons. All the doors and bulkheads appeared to be perfectly tight, and after pumping out the water no sign of strain or deformation was observable.

ELECTRICALLY DRIVEN VENTILATING FANS.—Naval Constructor W. L. Capps, U. S. N., in his report upon the battleship Alabama, advises the use of electrically driven fans in each compartment in preference to steam fans and long ventilating pipes. The ventilation of the Kearsarge is more satisfactory than that of the Alabama on account of the difference in the system. Mr. Capps says in his report that there can be no question as to the results obtained in the two vessels, and as the electrically-driven fans proved themselves so much better than steam-driven ones, he strongly recommends that electric driving be substituted for steam in all future construction. The adoption of electric driving, however, ought only to be one step towards the complete revision of our ventilating apparatus. The compiler is not familiar with the systems on the Kearsarge and Alabama, but the ventilating of previous ships is certainly wofully defec-

tive. The ventilating trunks were unsightly and much in the way. The air discharge took place in a way to obstruct, rather than assist, the natural air currents. The louvres were all of one size, regardless of distance from the blower, and of a design which seriously interfered with easy circulation and wasted much power; the similarity of size of course caused all of the air to flow out of the louvres near the blower where the pressure was highest; from the distant ones not a breath of air. The supply of fresh air, in some cases, was drawn from a ventilator situated over a fire or engine room hatch and drew in the heated air, pumping it down against gravity and to the discomfort of those below, thus doubly losing in efficiency. The long ventilating trunks pierced water-tight bulkheads and double bottoms and often menaced the safety of the ship, the bulkhead valves adding little to security while they nearly destroyed the usefulness of the pipe as an air-duct. Places like the engine-room, dynamo-room, and workshops are hard to ventilate but a great deal more can be done than has been attempted. If the steel bulkheads, floors, ceilings, etc., be covered as far as possible with a non-conductor of heat, much of the difficulty is obviated. These surfaces become heated by conduction, by radiation, and by escaping steam and heated air and they disperse by radiation and conduction a great part of this heat through the air. As at present fitted no reasonable amount of air can keep these compartments at a comfortable temperature. With the stationary surfaces covered by a non-conductor of heat a moderate amount of fresh air supplied and diffused at the *bottom* of the compartments, so as to aid and not obstruct the natural currents, might achieve success. The defects of ventilating apparatus are not so noticeable in temperate climates, even in summer, as the sea water is comparatively cool, but in the tropics every defect is at once painfully apparent.

ALUMINIUM THERMIT.—On Wednesday Dr. Hans Goldschmidt, of Essen, gave, at 29A, Gillingham Street, Westminster, a very successful demonstration of welding by means of his aluminium thermit before a large audience of leading engineers, metallurgists, and chemists. The process has repeatedly been mentioned in our columns, and was described on pages 386 and 450 of our last volume. A mixture of powdered aluminium and iron oxide constitutes the thermit, which is kept in soldered boxes, and can be bought at the rate of less than 1s. per pound. This mixture is perfectly harmless, and molten iron may be poured into it without starting any reaction. If, however, a primer, consisting of powdered aluminium and some peroxide, is applied, the reduction commences at once. This was the first experiment. A little of the ignition powder is dropped into a crucible and lighted with a common fusee. It flares up, and when thermit is gradually added, the whole mass begins to boil. A minute, or less, later, the fused alumina which floats on the top may be poured off, and the molten iron then made to follow. To show the intense heat, a bottomless crucible was placed on the top of an iron plate ½ in. or more in thickness. The reduced iron bored a hole through the plate so quickly that the plate could be handed round before the heat had spread to the edge. Then two tubes, 2 in. in diameter, were welded together endways, a box of sheet iron being loosely fitted round the joint, and another box, packed with sand, outside this. In this case the heat alone acts, the reduced iron is not wanted really. Therefore, some of the alumina is poured out first and directed against the tubes, surrounding them with a protective layer of this oxide. After a minute

the bolts which clamp the tubes together are tightened by, perhaps, ⅛ in.; a minute or two later the box frames are knocked off, and the iron and alumina also come off neatly without the slightest trouble. A beautiful weld results. An experiment with a larger tube was equally successful. Then two heavy tram rails were welded together. Boxes packed with sand had been placed about them, and the rails were held in position by two bolts, one on each side. Above the joint stood a crucible, taking about 25 pounds of thermit and closed below by a thin plate of iron. In this instance, a little ignition powder was simply sprinkled on the top of the thermit and lighted in the usual fashion by means of a fusee. The mass soon burned its way through the under plate, and a minute or so afterwards the bolts could be tightened. That practically finishes the weld. As no fishplate nor drilling is required, the Allgemeine Thermit Gesellschaft, of Essen, can weld rails on the terms usually paid for making a good joint. The process has been adopted in a good many towns, and has given great satisfaction. Some fine specimens of work done by aluminium thermit were exhibited, among them a welding of cast iron and steel, and many test bars, none of which had in the testing machine ever given way at the joint. The aluminium applied is the commercial aluminium of American and other works, of 98 per cent and more. The powdering and mixing, the manufacture of the partly magnesia-lined crucibles and box frames are all done at the Essen Works. The alumina which results as a by-product is an exceptionally pure corundum, which is sold to emery works. Messrs. Fox, Thicknesse, and Hull, of 32 Victoria Street, S. W., are representing Dr. Goldschmidt in the United Kingdom. —*Engineering*, London, May 3, 1901.

ALUMINIUM: WELDING.—A firm of Hanau, Germany, has succeeded in welding aluminium without the use of any metal, solder, or acid, says the *Scientific American*. No seam can be detected, and the welded pieces can resist blows and temperature variations as well as if there were no joint. The process is a secret one.

GUNPOWDER AND EXPLOSIVES.

EROSION OF GUNS.—This is a matter attracting the greatest attention in Great Britain and Italy, where nitroglycerin powders still continue to be used. The subject was treated at some length in the Notes of PROCEEDINGS *No.* 97, but some further information is at hand confirmatory of the general correctness of the theory therein advanced. As a preliminary to discussion it is desirable to present some of the facts in regard to erosion.

In forwarding a brief of the records of a 5-inch, 40-caliber gun in use at Indian Head Proving Ground, Lieutenant W. G. Turpin, U. S. N., says:

"This is a station gun and is particularly open to erosion from the fact that during the proof firing of the gun a pressure gauge was put by some mistake in the mouth of the cartridge case. This gauge scored the rifling very materially, so much so in fact that the gun was never sent out into service but was returned here to be used as a station gun. So far as you can see by close inspection there appears to be very little erosion. The gun has had a total number of rounds with smokeless powder of 719, divided as follows as regards pressures:

Pressures.	Rounds.	Pressures.	Rounds.
Below 5 tons	180	13 to 14 tons	48
5 to 7 tons	36	14 to 15 tons	85
7 to 8 tons	21	15 to 16 tons	86
8 to 9 tons	42	16 to 17 tons	11
9 to 10 tons	44	Over 17 tons	5
10 to 11 tons	44		
11 to 12 tons	44	Total	719
12 to 13 tons	53		

"Something over half of these rounds were fired at low pressures and low velocities; but the other 308 were fired at or above service conditions. The average pressure for this gun is between 14 and 15 tons. In addition to the above number of rounds this gun has been fired 140 times, using brown powder. I have not taken these into account in the table of pressures and rounds above given.

"This gun has recently been up at the gun factory and has been thoroughly cleaned and lapped out. The erosion does not seem to be of sufficient magnitude to reduce the velocities in the gun and is confined entirely to the grooves. The lands do not appear to have suffered in the least."

Lieutenant Dawson (late R. N.), a British ordnance engineer, in a paper read before the British Society of Arts, gives the following table of erosive action in a 6-inch gun using cordite:

EROSION IN A GUN USING CORDITE WITH A VELOCITY OF ABOUT 2500 F. S.

Distance from muzzle in inches...	234.5	232.	230.	228.	225.	222.	219.	216.
Wear of gun per round with special gas-check, inches	.0034	.0024	.002	.0017	.0013	.001	.0008	.0007
Wear of gun per round without gas-check, inches	.007	.0042	.0041	.0037	.0033	.0024	.0018	.0012

In regard to erosion Lieut. Dawson says:

"Nitrocellulose powder has the great advantage of being capable of producing in modern artillery the highest possible ballistics with the least possible amount of wear to the gun; and therefore at the moment its introduction should be treated from a most serious standpoint. It is, I think, well-known to all of you that the temperature of explosion of cordite is practically double that of nitrocellulose powders. This great difference in temperature of explosion has a great bearing upon the wear of guns, for with so high a temperature of explosion as cordite, far exceeding the melting point of steel, it is not reasonable to expect a gun to last many rounds, and especially if large charges are used, developing heavy volumes of gas. Now, in order to obtain high ballistics, it is very necessary to develop very large quantities of gas, with the view of keeping the volumes of expansion of the gas at the higher pressures as long as possible, and continuing these pressures to the muzzle of the gun. If cordite is used, having this very high temperature of explosion, these volumes of gas at the high pressure must of necessity affect the bore of the gun, especially at the commencement of the rifling. The nature of the wear of the bore with cordite is also very serious, taking the form as it does at the commencement of erosion of very thin fine lines, which develop as the rounds are continued, completely washing away the surface, and quite abnormally enlarging the seat in the gun, where the shot is rammed home. This, after a few rounds, allows the shot to be

over-rammed, increasing the volume of the chamber, which, in its turn, diminishes the pressure, reducing the energy of the gun, and varying the velocities, and therefore the range, accuracy, and, indeed, every point which to the gunner is an absolute essential. Furthermore, the wear of the bore of the gun prevents the proper centring of the projectile at starting, causing it in many cases to gyrate when it comes under the influence of the rifling. In guns of low power using cordite, where only small charges are required, the effect is, of course, much less than in guns using large charges; but I contend that as it is necessary for modern artillery, except that for special purposes, to have the highest possible ballistics, it is of primary importance to use a powder which, as far as possible, gets over the objections I have just mentioned. The effect of using cordite in, say, 6-inch high-powered guns, having velocities of 2800 to 3000 feet, is to entail a loss of some 500 to 600 foot-seconds, after about 200 rounds have been fired, representing a loss of energy of about 34 per cent, owing to the development of erosive effects. Furthermore, these velocities vary very materially with the temperature, and in some guns as much as 3 feet for every degree Fahrenheit. The question really comes to this: that if cordite is used, no higher velocity than, say, about 2500 feet can be obtained for any reasonable number of rounds, whereas with nitrocellulose powder, velocities up to and exceeding 3000 feet can be easily obtained, without the objections attendant upon the use of cordite, I therefore shall continue to urge that a nitroglycerin powder is not suited to modern artillery, and that any country continuing to use it must of necessity be at a serious disadvantage with a country making use of a nitrocellulose powder. The effects in other countries of powders containing from 10 to 25 per cent of nitroglycerin have, from an erosion point of view, been superior to those containing a higher proportion, but with such a powder a much larger charge has to be used in order to obtain the same ballistics, and the saving in erosion is not so great as one would naturally in the first instance think. A certain increase in the life of the gun can be obtained by using an efficient gas-check, and my diagram [omitted; it may be plotted from data given in the table at the beginning of Lieut. Dawson's remarks] shows the advantage of using the special form of gas-check shown [omitted; rotating band broadened and rear part contains two annular recesses apparently filled with obturating material and covered with a thin plate ring] thereon for making a metallic seal of the gas at the commencement of the travel of the shot and continuing it throughout the bore. The advantage of using such a gas-check is to lengthen the life of the gun, but it will have much more valuable results if used in connection with nitrocellulose powder than with a powder containing any percentage of nitroglycerin.

"As an example of the small erosion in guns when using a nitrocellulose form of powder, I would refer you to an experiment carried out in a Krupp 6-inch gun, in which—after some 534 rounds, 76 of which were fired with prismatic powder [brown] and ballistite—the dimensions of the bore were such that notwithstanding the damage done with the 76 rounds of powder other than nitrocellulose, the dimensions of the gun came within the acceptance limit of a new gun. It is only right, however, to add that in this gun the velocities were not very high, being only 2300 foot-seconds; but even this velocity is higher than that of the majority of 6-inch guns we now have in the service.

"The usual objection put forward to the introduction of a nitro-

cellulose powder is that it will not keep on foreign stations with variable climates. This I must state is erroneous; I have results of nitrocellulose powders stored in some of the hottest climates, and these have proved in every way satisfactory, both chemically and ballistically, when fired in guns. Some of the great German makers have had this powder under various heat tests for many years, and have reported to me their definite opinion that nitrocellulose powders, if properly made, are to be relied upon not to deteriorate any more than cordite and other nitroglycerin powders when subjected to variable climatic influences.

"I have heard it sometimes said abroad that better ballistics can be obtained in a rifle using nitroglycerin powders, as against cartridges made up of nitrocellulose powders. This belief is unfounded, as I have been able to obtain from rifle cartridges of the smallest size used in Europe higher ballistics with nitrocellulose powder than with cordite at normal temperatures, say between 60 degrees and 80 degrees Fahrenheit.

Having laid particular stress on the importance of nitrocellulose powders, because they are the only ones by which we can obtain constant high velocities up to say 5000 foot-seconds, I will now call your attention to my dangerous space diagram, showing the difference between the effect of firing with a high velocity and a low velocity." [This diagram is omitted; it is not germane to the present investigation. The subject of danger space, etc., will be much more fully treated than by Lieut. Dawson in a future number of the PROCEEDINGS.]

The following is from the *United Service Gazette* of March 30, 1901:

"Owing to the serious erosion in guns which is set up by cordite and other almost similar explosives they have been abandoned abroad, and a committee in this country, under the presidency of Lord Rayleigh, has been at work under the following terms of reference:

"(*a*) To carry out trials with a view to ascertaining what are the best smokeless propellants for use in existing guns of all natures, and in existing small arms.

"(*b*) To report as to whether any modification in the existing designs of guns is desirable, with a view to developing the full powers of any propellant which may be proposed.

"(*c*) To carry out trials with a view to obtaining a high explosive for shells which can be fired from all natures of guns and howitzers with as much safety as lyddite, with greater certainty of detonation, and with greater explosive effect.

"Now, Sir Henry Brackenbury, Director-General of Ordnance, acting under the Secretary of State, has directed a letter to all manufacturers of propellants and high explosives on the Home Office list, inviting them to submit, in confidence, any preparations under either head which give reasonable promise of proving more efficient than the present Service explosives.

"The committee have suggested the establishment in Great Britain of an institution similar to the Centralstelle fuer wissenschaftlichtechnische und untersuchungen, founded two years ago as a limited liability company, near Berlin. This organization was established for the exclusive benefit of a limited number of manufacturers, for the purpose of exercising control over their works, as regards the quality of the output, and to carry out such investigations, experiments, and researches as may serve to secure the highest efficiency and perfection for their manufactures. The interested firms submit their individual experiments to the

Centralstelle, where all the information thus collected is sifted and examined. Any new discovery which the Centralstelle holds to be of sufficient importance is communicated to those of the works interested in the Centralstelle to whom it may be useful."

Sir Hiram Maxim has taken out a patent in the manufacture of explosives (patent dated March 3, 1900) which is briefly described in the report of patents as follows:

"An explosive composed of nitrated guncotton pulp, ground to great fineness under edge rollers, together with 2 per cent to 15 per cent of resinous material. This compound is then pressed into blocks of suitable size for use in ordnance. The object of the added resinous matter is to prevent or diminish erosion, which it does through its richness in carbon. The carbon di-oxide which is given off from the present cordite, and which erodes the gun barrels, is thus displaced by carbon mon-oxide."

The following, which I derived from an article in *Arms & Explosives*, was published in the Army and Navy Year Book for 1895:

"Scattered through the literature of explosives may be found data for the combustion temperatures, or calorific intensities, of gunpowder, guncotton, and nitroglycerin, which vary between the following limits:

Black gunpowder .....3000° to 4000° C. (5432° to 7232° F.)
Guncotton .....5000° to 6000° C. (9000° to 10,800° F.)
Nitroglycerin .....7000° to 9000° C. (12,600° to 16,200° F.)

"These data appear the more remarkable inasmuch as the lowest temperature cited is above the melting point of most gun-metals. Von Winch has recently called attention to an error into which many observers have fallen in respect of these data—viz., the assumption that the specific heat of the products of combustion is independent of the temperature. He shows that this is not the case, and then, by means of a newly developed expression for the specific heat, he obtains, as the combustion temperatures, or colorific intensities, of the above explosives the following values:

Black gunpowder .....1874° C. (3405° F.)
Guncotton .....2516° C. (4561° F.)
Nitroglycerin .....3005° C. (5441° F.)

From the preceding data it appears that the chief cause of erosion is certainly not pressure, for with high pressures in guns using pyrocellulose powders the erosion is insignificant. It is not caused chiefly by temperature, for powders containing but a small percentage of nitroglycerin show very marked erosive qualities. It is not chiefly caused by escape of gas past the projectile through inefficient obturation of the rotating band, because it is almost nothing when pyrocellulose powders are used with guns and projectiles that give excessive erosion with nitroglycerin powders under the same conditions of pressure and velocity. It is true that an efficient gas-check decreases the erosion with the latter type of powder. But it is admitted by all that the use of a gas-check is only palliative and I doubt if it is of any use until after the erosion has made considerable progress, after which time the gas-check closes the gap around the projectile which the regular rotating band is no longer able to do. For of course no one doubts that the rush of gas past the projectile, *especially if this gas is rich in oxygen*, will undoubtedly cause some erosion. The experiments of Lieutenant Dawson are proof of this, but

plenty others may be cited. But there is nothing to show that a special gas-check would be of great value in guns using pyrocollodion powders. The present rotating band seems to act efficiently. In the case of cordite and Noble's powders (ballistite, etc.) the gas rushing past the projectile is rich in oxygen and it is brought in intimate contact with the metal of the bore, some of which has been burnished bright by the previous projectiles and so is ready for easy oxidation. There remains then but the chemical aspect of the question, a view of which was briefly presented in the last number of the PROCEEDINGS. Whether the chemistry therein given is perfectly sound or not, the compiler believes that the central idea advanced, which is that the principal cause of erosion (where it is of serious amount) is oxidation of the metal of the bore, is the true solution of the problem. The causes of erosion in guns using pyrocellulose are not here in question. The small amount that exists is probably due to a combination of chemical action and imperfect obturation and perhaps the latter is very much the greater factor.

Sir. A. Noble's plan of introducing water in the powder case in order to lower the temperature of combustion and so reduce the erosion (see "Special Powder Case to Reduce Erosion" in notes on Ammunition, page ——) seems wholly impractical and theoretically wrong. Such a contrivance is clumsy and, if recent investigations into the oxidation of iron at low temperatures (see "Rusting of Iron," page 195, PROCEEDINGS *No. 97*) give results which are true for high ones, the introduction of water is likely to add to the trouble rather than to lessen it.

DETONATORS WITHOUT FULMINATE OF MERCURY.—A German chemist, Dr. L. Wohler, has patented a method of rendering detonators less expensive and more efficient by substituting for part of the fulminate of mercury a quantity of trinitrotoluol. Trinitrotoluol is not so expensive as the fulminate of mercury, and not so much of the former substance has to be used as the latter. An example of the material for insertion in the detonator tube is as follows: Trinitrotoluol, 0.1 to 1.3 grains, according to the effect desired, is first inserted, and above that 0.1 to 0.3 grain of mercury is distributed. English patent date is February 16, 1901.—Chiefly from *Arms & Explosives.*

EXPLOSIONS OF MAGAZINES ON THE SPANISH SHIPS AFTER SANTIAGO.—There are probably many people who still believe that the Maine was destroyed by the explosion of her own magazine through negligence or accident. Some foreign writers have produced small volumes to explain away the manifest difficulties which beset such a theory when confronted with the facts of the situation, particularly the ascertained condition of the wreck. The officers of our service have very generally contended that while the watchfulness and discipline aboard our ships made such an accident almost impossible, the condition of the wreck after the explosion was such as to preclude the possibility that the cause was due to magazine explosion, on the ground that an internal explosion of gunpowder taking place below water would not drive the sides or bottom outward but force the decks up. Water, which yields so easily to slow movements, is like a mountain of granite to sudden blows like that given by powder pressure against the sides and bottom of the ship. If the water surrounding the Maine for a hundred yards in every direction were to have been replaced by a vast expanse of granite rock fitting her bottom with the same closeness and exactitude as the water, the resistance to forcing out of the sides by an internal gunpowder explosion would not have been greatly increased.

In my opinion a very conclusive case could be made out upon theoretical grounds based upon general knowledge of the action of explosives; but that is beside my present purpose which is to cite practical parallels. The three Spanish armored cruisers, Infanta Maria Teresa, Viscaya, and Almirante Oquendo, which were stranded and burnt in the naval action off Santiago, had many points in common with the Maine. They were almost exactly the same size as the Maine, differing from her less than three per cent in normal displacement and general dimensions, and having similar armor belts and protective decks. Moreover, the principal magazines and shell rooms were in the same general locations and contained about the same amounts of powder and other ammunition, so far as we can ascertain.

All the magazines and ammunition rooms of the Oquendo and Viscaya blew up, and some of those on the Maria Teresa, the others being flooded. What was the result? The decks were forced upward. In the case of the Maria Teresa, even the decks were not seriously wrecked. In the Oquendo and Viscaya I was unable to examine the condition of all the lower decks as some were submerged. The protective deck of both these ships, however, was in plain sight above water. The force of the explosions had lifted it bodily forward and aft where it covered the magazines, shearing the ends of the beams at the ship's sides and ripping it from its other fastenings at sides and bulkheads. So far as I recollect no hole was made in it anywhere. Some of the bulkheads, and perhaps all, surrounding the magazines and compartments immediately adjacent were blown down and wrecked in various ways. And yet not one hole in the sides could be found. And further—notwithstanding the destruction of the decks and beams which removed almost all the interior forces holding the ships' sides together—there was no exterior indication that the explosion had taken place. So far as I could see, and I looked most carefully, there was no distortion of the lines of the hull, not even a bulge. Above water the explosion of the torpedoes had ripped off many plates in the bows of these ships. But even here the damage was less than might have been expected, for the injury was confined almost wholly to the plating, the frames being very little injured.

The groups of magazines at opposite ends of the ships exploded separately; of these explosions I saw two—one on the Viscaya at close range, while we were picking up her crew, and just after Captain Eulate had been brought on board and was being taken below. It was a most impressive sight. A vast cloud of white smoke gushed up with enormous velocity to a height of many hundred feet and then spread out, forming a figure like a great palm tree. Those who happened to be looking at that part of the Viscaya said the white smoke was preceded by a tongue of flame and thin smoke which shot up as high as the masthead. The others of us who were an instant too late saw only the after rush of smoke. Almost simultaneously with the appearance of this smoke column—which I conclude came through a very large hatch—the smoke puffed up all around the deck and for a moment hid that end of the ship almost completely.

The results of the explosions, coinciding with our previously conceived ideas, are to my mind practically conclusive as to the ordinary effects of magazine explosions in ships. The very moderate damage from the explosion of several torpedoes (at least three), quite close together, in the bow of the Viscaya, make me exceedingly sceptical as to the great

destruction to be expected from high explosive shells in future naval warfare. The radius of destructive effect was so strikingly limited in this case that I cannot see how a single shell, containing perhaps not one per cent as much explosive, can be so hideous a missile as it is, in Europe, popularly held to be. The stories of the condition of affairs found upon old ships after recent firing experiments may be wholly correct; but if so I believe the same condition is to be expected from the explosion of an equal number of shells charged with gunpowder. The high-explosive shell charge breaks up the shell into so many fragments that they must act like shrapnel.

The results of the torpedo explosions referred to above seem fully to sustain Professor Alger's contention that the effects of the explosion of a torpedo in a tube above water would be chiefly confined to the compartment containing it.

GUNS: FIRING.

NOTE.—Under this head will be given notes referring to firing tests of guns, target practice, special practice, accidents to guns while firing, etc.

TRIAL AND DESCRIPTION OF 5-INCH, 50-CALIBER GUN, M'99, FOR U. S. NAVY.—The following is furnished by Lieutenant W. G. Turpin, U. S. N., assistant inspector of ordnance, Indian Head:

This gun is of a new design, being approximately 50 calibers in length and designed to give 3000 f. s. velocity with smokeless powder; chamber pressure, 17 tons.

The new features of the gun are: the return to the plastic obturating pad and the consequent discarding of the cartridge case; and enlarged powder chamber, the volume being 1186 cubic inches as compared with 657 cubic inches in the 5-inch, 40-caliber gun.

The breech mechanism is of the Vickers type. This mechanism is on the slotted screw system, with three blanks and six threaded segments. Each segment of a set of three is made with a different radius, the difference being about equal to one and one-half times the depth of the thread. This arrangement allows the block to have a holding surface of two-thirds its circumference, instead of one-half, as in the older style, and consequently permits the use of a shorter breech block with equal strength. The block is carried on a brass arm which is hinged to the jacket, and when the block is closed this arm is close up against the rear face of the gun. A lug with a slotted screw on one end of this arm carries the block and through this lug the mushroom stem is carried, the latter being secured by means of a nut. The primer seats in the rear end of the mushroom stem. The lock is carried by the carrier arm, and is automatic so far as ejection of the primer is concerned. Both electric and percussion gear is fitted.

The mechanism is operated by means of a lever pivoted to the carrier arm. The motion of this lever is transmitted to the block by means of worm gearing and a connecting rod. This latter rod operates the lock mechanisms. The lock can be cocked without opening the breech. As in all recent types the gun is trunnionless and recoils in a sleeve. The recoil is taken up in the usual manner. Telescopic sights are to be used. The mount shows no very novel features, being an improvement on former types. The training and elevating gears are so arranged that the

wheels are together and are worked by the gun-captain, who can keep his eye on the sight and manipulate the gun.

The weight of the powder charge is from 45 to 50 per cent of the weight of the shell, the latter being 60 pounds. Recent trials of this gun gave the following results:

Charge (pounds).	Pressure (tons).	Velocities (f. s.)
16	5.7	2040
26	16.4	2990
27	16.95	3101
28	18.23	3221
28.5	19.3	3255

The powder used was a 6-inch smokeless powder, and as shown in the above table gave about 3000 f. s. with a chamber pressure of 16.4 tons. No tests for rapidity have been made but with aimed shots the gun can be loaded much more rapidly than is consistent with good shooting.

TRIALS OF U. S. ARMY 12-INCH GUN WITH MAXIMITE SHELL.—Some interesting experiments with maximite have recently been made at Sandy Hook. The exact composition of maximite is not given out but it is stated to be a picric acid mixture consisting mainly of a picrate. The products of its combustion are almost wholly gaseous, and as the heat developed is very great, and the gaseous volume large, its power when detonated gives it a high explosive value. It may be fused at 174° F. instead of 252°, which is the melting point of picric acid. If heated it first melts and then evaporates until it wholly disappears. A very remarkable feature is that in its unconfined state it cannot be heated fast enough to produce an explosion. Set on fire in the open air it burns like pitch, and an illustration in the *Scientific American* shows the inventor in the act of pouring molten iron on a mass of it.

The following is from the *Scientific American:*

"Among the first tests of this material by the Ordnance Board was the firing of a 5-inch armor-piercing projectile through a 3.5-inch, nickel-steel, armor plate. The projectile was recovered intact from the sand butt behind the plate. It was then armed with a fuse, buried in the sand, and exploded for fragmentation. The sand was sifted and over 800 fragments recovered.

"About the same time, a 12-inch armor-piercing shell was filled with maximite, buried in the sand, and exploded for fragmentation. More than 7000 fragments were recovered. Following this test, a 12-inch, armor-piercing, forged steel shell, containing 70 pounds of maximite, was fired through a 7-inch, Harveyed nickel-steel plate, and was recovered from the sand behind the plate. This 12-inch shell and the 5-inch shell above-mentioned were, of course, fired from the gun without a fuse, as the test was one for insensitiveness only, to ascertain if the explosive would stand the shock of perforation of armor plate.

"The next test was to fire a 12-inch, armor-piercing shell, carrying 70 lbs. of maximite, and armed with a fuse, through a 5.75-inch Harveyed nickel-steel plate. The fuse used in these tests is the invention of an army officer, and it has shown itself capable of standing the shock of penetration of armor plate as thick as the projectile itself will stand to pass through. But it is difficult to always get just the exact amount of delayed action, so that the shell will explode the moment it has passed through the plate, not either in the plate or 100 yards beyond. The time

is gauged to hundredths of a second. It is better to explode when half or two-thirds of the way through the plate than to explode too far beyond it. Hence it is preferable that the shell should go off a little too soon than too late. This 12-inch shell exploded when it was about half-way through the plate. The violent effect of the explosion upon the plate, shattering it into fragments, with the destruction of the abutment where it was supported, is shown in the accompanying photograph, in which the deep scoring of the shell should be noted.

"It should have been stated that preceding the last two tests above-mentioned, something like half a dozen six-pounder armor-piercing shells filled with maximite, and without a fuse, were fired, in competition with shells similarly filled with fused picric acid, against plates of varying thickness. The picric acid detonated on impact when fired at a plate 1.5 inches in thickness, while the maximite shells, of course, did not explode. The maximite shells were then fired at a plate 3 inches thick, some of them passing through and others sticking in the plate. A photograph shows the points of two of these shells, one just through the plate, and the other about half way through. None of the maximite shells exploded, and they still remain in the plate, filled with the explosive. One of the maximite shells which struck this plate penetrated about half way through, upset so that it was shortened nearly two inches, and burst open at the side, the unexploded maximite being forced through the rupture, and the shell rebounded from the plate about 200 feet and struck in front of the gun without exploding. In an accompanying photograph this distorted shell is shown beside one in its original shape and length.

"Perhaps the most remarkable of all these tests that have been made at Sandy Hook were the last three, as described below.

"On May 1st a 12-inch, armor-piercing projectile, carrying 23 pounds of maximite, was fired without a fuse through a 30-ton Harveyed nickel-steel plate, 12 inches thick. The shot was recovered in perfect condition, its load of explosive having stood this terrific shock without explosion.

"Following this test, a similar shot, also holding 23 pounds of maximite, and armed with a fuse, was fired through the same plate, exploding when about two-thirds through, the fuse being about two-hundredths of a second too quick. Two photographs show the abutment before and after the projectile exploded in the plate, the second showing the plate broken, the fragments strewn around, and one, weighing several tons, resting upon the top of the structure.

"A very interesting test was the last one of the series, and which took place on Tuesday, the 7th instant (May, 1901), when a 12-inch mortar shell, known as the torpedo shell, was fired from a 12-inch sea-coast rifle at full velocity and pressure, with a charge of brown prismatic powder. This shell carried 143 pounds of maximite, was armed with a fuse and fired through a sand crib faced with heavy timbers. The velocity of the projectile was probably about 2100 feet per second, and, as the column of explosive was four feet long, the shock of acceleration upon the maximite must have been very severe, although not comparable, of course, with the shock on even a much shorter column in penetrating heavy armor plate. This was the largest charge of high explosive ever thrown from a powder gun in a service shell, and at service pressure and velocity. The projectile exploded just as it emerged from the back side of the crib. It was broken into very small fragments, averaging from the size of a rifle ball to several ounces. A crow and a ground sparrow were

struck upon the wing and brought down from the sky by the flying fragments, and fell near the sand crib, the sparrow falling directly into the crater, a result which suggests the completeness of the fragmentation."

ARMSTRONG GUN ACCIDENT.—[See PROCEEDINGS *No.* 97, page 204.] We learn that the particulars given in a letter by "Verax," re an accident to an Armstrong gun on board the Terribile, of the Italian navy, and published in our issue of March 1 are totally inaccurate. There was, it is true, an accident to the breech, but it arose from the charge exploding before the breech was closed. "Verax" asserted that the breech blew out owing to weakness of the screw, and to lend "corroborative detail to a bald and unconvincing narrative," proceeded to affirm that Messrs. Armstrong had, after a similar accident in 1890, modified the design of the screw. This, we find, is quite incorrect, the only changes made in the screw since its first introduction, having been in details connected with new firing gear or mechanism.—*Engineering*, London.

MORTARS AND HOWITZERS.—High angle fire is at present falling out of favor. This is not surprising. Why it was ever highly regarded is the proper subject for wonderment. The object of a gun is first to hit and then effect damage upon the enemy. The chances of hitting stationary objects with high angle fire are very small; when the object is moving at unknown and variable speeds and at imperfectly known distances the chances become very small indeed. Now as to probability of serious injury if the hit is achieved. In guns of high velocity and flat trajectory the projectile has a high speed of rotation sufficient to keep it moving point first. When the velocity of rotation falls to a certain point the shell will "tumble." In rifled mortars the rifling is useless as regards steadying the projectile at the end of its flight and perhaps serves no useful purpose whatever. The rotation of the projectile is probably insufficient to preserve the direction of the axis long before the shell reaches its maximum altitude (elevations in excess of 30° presupposed). It then falls tumbling. If it strikes with its point down and axis inclined at less than 45° with the vertical it may have some penetrative force due to the point, but probably would not—if tumbling rapidly—unless its axis on striking was within 15° or 20° of the vertical. If the shell had no rotary force left and fell freely along the second half of its trajectory, a specially dense and heavy head and light and long body might cause it to come down point first. But the feeble remaining rotation would probably prevent this in ordinary howitzer shell, so that we may presume the projectile falls freely. With a freely tumbling the chance of its hitting point down and within 45° of the vertical is 1 in 6.7. The actual probabilities are likely to be better than this as the weight and shape ought to exercise some effect, possibly improving the chance to 1 in 5. Its velocity is feeble, however, and unlikely to make it go through more than one or two decks. The 8.2-inch howitzer shell which hit the Indiana (a purely accidental hit, at night and at an unknown distance—indeed, it was not even fired at her) went through the flash plate and the deck plating beneath, struck the protective deck and exploded. The protective deck was scarcely dented.

In regard to the probability of striking the object at which the howitzer or mortar is firing General Miles stated before the sub-committee on appropriations:

"They are not being constructed by any government in Europe. They have never been tried in war, and our experience in the Spanish War was

that the guns in barbettes at San Juan were able to stand off our fleet without the assistance of either disappearing guns or mortars. The mortars have never been tested in actual warfare, and to only a limited extent in target practice." General Miles said: "As to mortar projectiles, the theory is that they will go up in the air and come down point first and go through the deck. They will not do anything of the kind. In coming down they strike either base-end first or on the side.

"A striking illustration of the inaccuracy of mortar fire was given in France some ten years ago. In order to test the comparative protection from vertical fire afforded by the German coast-defense turret and the standard French turret, it was decided to make a practical trial. An 8-inch rifled mortar was used. The two turrets were erected at a distance of 2000 yards from the mortar. The test was finally abandoned, because after firing for more than a month and using hundreds of rounds of ammunition in the attempt not a single shot had struck either turret."

A mortar projectile does not penetrate unless it comes point down and there is nothing to compel them to do so. "A projectile out of a high-power gun is going point on, and you know if there is a battleship anywhere within a mile in the line of fire that battleship is going to be struck. But, on the other hand, the mortar sends its projectile up into the air and it then comes down somewhere. If the ship happens to be under it it will strike it, but whether it will do it any harm or not I do not know; if not, there is just so much money thrown away."

TESTS OF U. S. SEA-COAST MORTARS.—The artillery members of the Board of Ordnance and Fortifications met in New York Friday, May 16, for the purpose of arranging the details for the coming test of 12-inch mortars to be held this summer at Portland, Maine. This test will, for many reasons, be exceedingly interesting. It will decide, once and for all, the merits of the mortar as an engine of warfare for coast defense. Over 200 shots will be fired from the mortars at a target about 2000 yards distant. There are now sixteen of these large mortars at Portland, and the general conditions there are exceedingly favorable for the test. The mortar still has many strong adherents in the army, but a majority of artillery officers have a poor opinion of its worth. The result of the test, which will be exhaustive, will be awaited with much interest.—*Army & Navy Journal.*

BROWN SEGMENTAL GUN TESTS.—The powder tests of the 10-inch Brown segmental wire-wound gun which began on February 21, at the Sandy Hook proving grounds, were completed on Thursday, March 7. General Miles, Gen. John M. Wilson, Gen. Thomas J. Henderson and Col. John I. Rodgers, members of the Board of Ordnance and Fortifications, and Capt. Isaac N. Newton, the recorder of the Board, were present. Six shots were fired, using up the 850 pounds of smokeless powder on hand for the test. A slight defect in the welding of the "field shield" or outer sheath of the gun tube developed after the first shot had been fired on February 21, and the test was postponed in consequence. This outer wrapping had been welded at a steel plant without necessary facilities, the better equipped plants being unable to undertake the work on account of press of orders.

While the members of the board naturally did not express an opinion as to the merits of the gun in advance of their report, the gun company report that the six shots left the gun unstrained. A maximum pressure of 37,300 pounds to the square inch was developed, with a velocity of 2500

feet a second. No United States Army gun of the same or greater caliber has, it is said, ever attained such velocity before.—*Army & Navy Journal*, March 9.

At the recent meeting of the Board of Ordnance and Fortifications a letter from the manufacturers of the Brown wire-wound gun, in which it was requested that permission be granted to enlarge the chamber of the 10-inch gun, was considered and approved. The gun as now chambered is intended for nitroglycerin powder, but as this country has decided not to use this kind of powder it has been found necessary to enlarge the chamber of the 10-inch gun in order to get the necessary velocity of 2800 feet per second.—*Army & Navy Journal*, April 20.

Belleisle: Refitting for new Experiments.—The preparation of the Belleisle for the next series of experiments has commenced. The following is the program, which will take two or three months to complete: On the port side, plates of 4-inch Krupp armor, similar to that supplied for the Essex class, will be placed. On the starboard side, 6-inch Krupp armor, identical with the Drake's plates. These plates will run along the lower deck for some distance both before and abaft the redoubt. The old flat armored deck of the Belleisle is being removed, and a 2-inch turtle back will be substituted. This will reinforce the 4-inch and 6-inch plates in places—elsewhere it will be behind unprotected sides, as the ship will be submerged sufficiently for the old belt to be under water. The virtue of deck protection, pure and simple, will also be tested. As, all told, the world has built several hundred cruisers on this system, it is, perhaps, time to try and gauge its value. It seems, however, to have been left to the much-abused British Admiralty to think of this.—*Army & Navy Journal*, April 13.

Infantry Fire versus Machine Gun.—From trials recently made at Querqueville, near Cherbourg, it has been deduced that one machine gun served by two men will develop as much effective fire action as 200 rifles. Fifty marksmen were chosen from the Colonial Infantry to compete with the Hotchkiss 8-millimeter gun which has lately been adopted for the French Alpine troops. The ranges fired at were 400 and 750 meters. At 750 meters distance (820 yards) the fifty riflemen, firing each five rounds independently, obtained 54 hits, or 22.6 per cent of the number of rounds fired. Thirty-two men were then chosen from among the fifty, and these had to fire each eight rounds in 30 seconds. Under these conditions 34 hits, or 13.3 per cent of the rounds expended, were recorded. The machine gun was then brought into action, and in 38 seconds fired 211 bullets, making 145 hits. Needless to say, these results are greatly in favor of the machine gun, and further tests led to the conclusion being arrived at as already stated.—*Arms & Explosives*, May, 1901.

Firing at a Submarine Boat.—At Lorient dockyard, France, trials are to be made of a caisson, constructed to represent the submarine boat Gymnote, which is to be subjected to the plunging fire of light guns from ships—the idea being to ascertain if these would be effective against submarine boats navigating awash or seen just below the surface.—*Army & Navy Gazette*, London.

Modern Gunshot Wounds.—Dr. E. F. Robinson, in "Annals of Surgery" for February, thus sums up his conclusions in an article on gunshot wounds in the Philippine war: 1. The modern gunshot wound is generally aseptic, and should be treated on this supposition. 2. Asepsis is due chiefly to the character of the bullet and the early application of

first-aid dressing, and, in a minor degree, to the velocity of the projectile. 3. Primary hemorrhage from modern gunshot wounds is exceedingly rare, the blood vessels being displaced rather than cut by the rapidly moving projectile. 4. The "explosive effect" of the modern bullet is much less common than recent military literature would indicate. This peculiar destructive effect is produced by the character of the tissue struck, as well as by the great velocity of the bullet. 5. Gunshot wounds of chest are rarely infected. Simple antiseptic treatment, with aspiration of pleura in cases of severe hemorrhage, is all that is necessary. 6. Gunshot wounds of knee-joint are usually aseptic, but, if infected, demand immediate amputation to save life. 7. Excision of elbow is always a justifiable operation in severe shattering or infection of that joint. Resection of bones of other joints is rarely necessary, erasion or amputation being preferable. 8. Injuries of nerves from gunshot wounds can often be benefited by operative interference or resection. 9. In modern military surgery abdominal section for gunshot wound is not justifiable; the patient's best chance of recovery lies in conservative treatment without operation.

A. Horman, M. R. C. S., in the *Intercolonial Medical Journal* in an article on "Surgical Experiences in South Africa," says: "It may be of some interest from a medico-legal point to notice the effect of a grazing wound. It gives the appearance as if the skin had been burned by a hot iron laid upon the skin; this is due to the removal of the superficial epidermis, exposing the true skin, which becomes brown after a few hours."—*Army & Navy Journal.*

GUN MOUNTS.

STRAUSS GUN BEARINGS.—A recent English patent has been taken out by Lieutenant J. Strauss, U. S. N., on improvements in gun bearings. The brief of the patent is given as follows:

The gun bearings described in this specification are constructed so that they have every capacity for withstanding the shock of recoil, and yet offer the smallest possible resistance from friction to the turning of the gun in elevating or depressing it. The ordinary trunnions are used, and are mounted in the usual way. These take the shock of recoil; but from the faces of these project supplementary trunnions, which have ball-bearings. There is thus only rolling friction in the moving of the gun to elevate or depress it. Accepted March 24, 1900.

NEW SECTIONAL RAMMER.—A sectional rammer recently patented by Sir W. G. Armstrong, Whitworth & Company and C. H. Munroe, Newcastle-on-Tyne, seems to offer some advantages. The rammer consists of steel troughs (such as might be made by sawing a number of concentric hollow cylinders into two equal parts longitudinally). The edges of the troughs are up and all lie in the same horizontal plane. The edges all carry precisely similar geared racks. At the front end each trough stops a little short of the one inside of it. A transverse geared shaft long enough to reach across the widest trough is placed just in rear of the position of the head of the rammer which is on the inner trough (this is really only a bar—the other sections are troughs) when the rammer is drawn fully back. Upon actuating the transverse shaft, its gear first draws out the inner bar carrying the rammer head. When this reaches

its full travel to the front it becomes locked in place in the head of the next outer trough which latter is drawn forward until its teeth engage in the gear on the shaft, and so on. When the rammer is withdrawn each section is pulled to the rear in turn and unlocked when the preceding section is fully home.

INSTRUMENTS USED IN ACTION.

NOTE.—Under this head will be given notes on searchlights, range-finders, stadimeters, torpedo directors, etc.

RANGE-FINDERS.—In our service the apathy shown towards developing a proper system of range determination is deplorable and it is surprising in view of the attention paid to target practice. The inaction is due partly to a distrust of range-finders, both as to reliability of operation and precision; partly to lack of thought on the subject; but more than all to a belief that ranges can be guessed by trained marksmen or determined by the fall of projectiles.

Considerable experience in training men to estimate ranges has convinced me that the average man can guess distances of objects within 500 yards when they are not more than 2000 yards away, but beyond 2000 yards his estimates are very wild, the error short often exceeding 50 per cent, and the error over frequently exceeding 100 per cent of the known distance. With our present service guns (giving a velocity of 2300 f. s. with smokeless powder) an error of 500 yards in range corresponds to a vertical error of about 15 feet at 2000 yards for 6-inch guns—slightly more for smaller calibers and slightly less for larger ones. In other words, if the gun be pointed a little below the center of a vertical target 30 feet high, and other sources of error be neglected, an error of 500 yards in range will cause the point of the projectile to strike just at the upper or lower edge, according as the estimated range is too great or too little. With our new 6-inch guns (Model '99, muzzle velocity 2900 f. s.) an error of 500 yards in a range of 2000 yards will cause the projectile to miss a vertical target 13.5 feet high. At 3000 yards the vertical target for 500 yards' error is about 20 feet high for the new 6-inch gun; for the old 6-inch with 2150 f. s. the vertical target under these conditions is 37 feet and with 2000 f. s. it is 42 feet.

It is evident that if we have certain large unknown errors which we do not allow for, and for which the gun firer does not correct his aim, then the better the training of the gunner the less is he likely to hit. If he were a perfect shot he would never hit the target at all if furnished with a range sufficiently erroneous, whilst a poorer shot would hit occasionally.

Now this is manifestly wrong. Our training should not be worse than thrown away. We must reduce large errors to small ones, or else determine them exactly. Under the present conditions by far the largest error in gun-pointing is due to error in range, and I see no evidence on any hand of an attempt to improve this state of affairs. It was the cause of the waste of ammunition at Santiago and perhaps in our next war it will be the cause of a crushing defeat.

I have referred to the error of estimating ranges. I forgot to say that these errors were made by men who were unexcited, calm, intent simply upon guessing the distance and with their field of view unrestricted.

What the results would be under unfavorable circumstances of battle I cannot say, but certainly the men could not guess so well.

Now as to the possibility of getting the range by the fall of projectiles. In my opinion this does not exist at any ranges unless you are willing to sacrifice all that we have gained in rapidity of fire in a quarter of a century. It is one of those ideas left over from the age of muzzle loaders, perpetuated by an unthinking consideration of target practice and a lack of appreciation of battle conditions.

At the battle of Santiago, in the heat of the action, two hundred shells per minutes of various calibers were striking the Spanish ships or falling about them and were chiefly directed against one ship at a time. It was not possible to tell where any particular shot came from nor whether your own shell fell short or went over. Ranges were constantly received from an officer in the top but they were nearly always useless, for it was not certain which ship was—or rather had been—at the range reported; and the interval between the taking of the range and its report at any particular group of guns constantly varied. Moreover, the changes of direction and of speed added further difficulties to a complicated situation. All this would have been saved by having separate range-finders for each group of guns.

In single ships actions in which the ships engaged are small, guns few and readily controlled by one person without serious sacrifice of speed of fire, it may be practicable to correct the range by the fall of projectiles, but in all other cases, *No*—a thousand times No! And it is unnecessary that it should be. We can train the gunner to know his gun and the motions of his ship, and to be able to allow for most of their idiosyncrasies, only when he is furnished with correct distances of the target. Having trained the gunner so that he has such command over his firing that he can hit an ordinary target at a reasonable known range, it becomes necessary, in order that we shall benefit by his training, that the correct range shall be supplied him in battle.

The only acceptable range-finder is one of the auto-base type. Two such are described in "Notes on Naval Progress" (office of Naval Intelligence, July, 1900). Their errors at various ranges are interesting and do not bear out the statement one often hears to the effect that range-finders are too inaccurate to be of any use. The Barr and Stroud range-finders gave the following:

Range (yds.)	326	1975	5950
Mean error (yds.)	0 04	3.3	25.0
Extreme error (yds.)	0.40	15.0	50.0

The errors of the Zeiss stereoscopic range-finder are thus reported:

Range (meters) 500	1000	2000	4000	8000
Mean error (meters) —	5	18	70	280

On a vertical target, with our new guns, these errors of range would be wholly negligible. They would not displace a 6-inch shell by an amount equal to its caliber at a range of 2000 yards. In the face of such results how shall we characterize attempts to obtain range by estimation or guess? Doubtless to keep the errors of observation as low as those recorded in the tables here quoted some training of the observer is necessary. But if only a small fraction of the time that is spent in

training a gun-pointer is devoted to training a range-finder man, he will probably be a skilled observer. In examining and testing such instruments many people are prone to reject them because they cannot at once be used with full success and perfect ease.

To obtain all the advantages of the use of range-finders they should be numerous. One should be supplied to every group of guns (also some spare ones to replace those injured) so that the range may be furnished promptly at the moment desired and so that there can be no doubt that the pointing and ranging are for the same ship of the enemy's fleet. One range-finder man with one or two assistants should supply distances, speeds, and courses of the enemy—for of course this is easily possible with good range determination. Such an allotment as here described would require ten or fifteen instruments for large ships, exclusive of the spare ones. And in no other way will a hundred times the expenditure add so much to the power of our fleet.

It is urged that all the range-finders so far installed are easily thrown out of adjustment and will not stand the shock of firing. So far as I have seen this is not true of late models which are about as reliable as telescope sights. Both require reasonable care.

FISKE TURRET RANGE-FINDER.—Lieutenant-Commander B. A. Fiske, U. S. N., has taken out patents in the United States and Great Britain of which the claim is as follows:

CLAIM.—(1) The combination with a revolving turret, of an optical range-finder carried thereon and constituting a permanent fixture thereof, whereby the range-finder will be trained on the target by the rotation of the turret, said range-finder comprising a telescope and two reflectors, said reflectors being secured at approximately the opposite ends of a diameter of the turret, which diameter thereby constitutes the base line of the finder, and means for vertically aligning the rays which come from a distant object to said opposite ends of the base line, substantially as set forth. (2) The combination with a revolving turret, of a range-finder carried thereby and comprising a telescope, the eyepiece of which is out of line with its objective, said telescope being mounted near one side of the turret and through which the target is observed directly by the observer within the turret, a reflector mounted opposite said telescope and by means of which a reflected image of the object will be observed through the telescope, and means for adjusting the angle of said reflector, substantially as set forth. (3) The combination with a revolving turret, of a cross bar pivoted to said turret, a vertical telescope carried by the cross bar and projecting downward into the turret, a reflector carried by said telescope, a reflector carried by the cross bar at its opposite end from the telescope, and means for adjusting the angle of the latter reflector, substantially as set forth. (4) In a range-finder, an observing telescope movable relatively to a fixed pivot, with the eyepiece of the telescope in approximately the line of said pivot, whereby the adjustment of the telescope to maintain an object in the field of view does not effect a relative movement of the eyepiece, substantially as and for the purposes set forth.

SEARCHLIGHTS AND TORPEDO BOATS.—Searchlights are liable to play an important part in the warfare of the future, and the recent manœuvres in the Mediterranean demonstrated that the projectors would be an effective means of defense if properly used, but that very careful consideration should be given to the position from which they are used, and a writer in

the current number of the *Electrical Review*, in an article on the use of searchlights in naval warfare assumes that in the case of a fleet steaming in company on a dark night and attacked by torpedo boats, the only means of defense would be to turn all the searchlights on and endeavor to repel the attack by a sharp gun fire, and that under these circumstances the chances are in favor of a successful attack, although several of the boats may be put out of action. What he does not take into account is that the fleet would almost certainly be accompanied by destroyers fitted with searchlights close to the water's edge. The fleet would stand a much better chance than he opines if the destroyers accompanying it used their searchlights, and the battleships their quick firing guns. The writer, however, gives an interesting account of some experiments which were made on the supposition that a ship lay temporarily disabled and at anchor in a port, and the means of defense adopted when she was attacked by torpedo boats. Two torpedo boats entered the harbor and discharged their torpedoes almost unobserved, although they had actually to pass through the beam of a searchlight at the entrance before they could get in at all. The searchlights on the water completely destroyed the vision of the occupants of the boats while in the ray, but the higher placed light, while giving a better target for the gunners, at the same time indicated the ships' position to the attacking boats. Colored glass shades were used by those in these boats with advantage by reducing the dazzling effects of the higher placed projectors, but they were of little use against the lower searchlights. The whole problem involves itself into this, that the gunners of the ship attacked, to insure good practice, should be as far removed as possible from the searchlight.—*Marine Engineer*, London.

SMALL ARMS.

LEE-PUDNEY RIFLE.—Messrs. S. Lee and R. C. Pudney have patented a rifle in which the principal novelty is a down-feed magazine on top of the breech. It is a bolt gun with handle at rear end of bolt, and requires the usual rotation of the bolt to release it.

NEW SWISS SHORT MODEL RIFLE FOR SPECIAL SERVICE.—The *Allgemeine Schweizerische Militarzeitung* of March 16 (1901) informs us that the troops of artillery of position (fortress, garrison, etc) companies of telegraphers, of balloonists, and of cyclists will be armed with a short rifle, caliber 7.5 millimeters, of which the systems of breech mechanism and of ammunition are the same as those of the model adopted for the infantry rifle, and which is designated as the "short model rifle 1889-1900." The new model differs from the infantry piece in the following particulars:

(*a*) The length of the barrel is the same as that of the cadet gun (593 millimeters = 23.3 inches). The total length of the piece is 8 inches shorter than the infantry arm.

(*b*) The weight of the short piece is 7.82 pounds; that of the infantry is 9.46 pounds.

(*c*) The magazine holds 6 cartridges.

(*d*) For the short gun the same sword bayonet is supplied as is on the gun used by the engineer troops.

As to other points the piece approaches closely the infantry model.

Up to ranges of 1000 meters its accuracy is nearly as great. By the adoption of a short gun, it has been sought to lighten the weights carried by troops which, while working, carry their rifles slung over the back. It will be sufficient, for a detachment left to itself, to protect it against surprise by the enemy's cavalry. The distribution to the designated special troops will commence very soon.—*Revue du Cercle Militaire.*

LUGER AUTOMATIC PISTOL.—The Board of Ordnance and Fortifications, as predicted, has recommended that $15,000 be allotted for the purchase of 1000 of the Luger automatic pistols, which recently made such a wonderful record in the tests at Springfield Armory. The sum allotted—for the recommendation of the board was instantly approved by the Secretary of War—is sufficient to furnish five of these pistols to each troop of cavalry in the service and as these troops are serving at the present time under the most varied conditions, this distribution will insure a thorough practical test of the arm. The commanding officers of the cavalry troops will be ordered to make a general report on the merits of the Luger pistol. In addition they will be directed to answer specifically the following questions relative to the pistol in actual service:

1. The advantages and disadvantages of automatic pistols as compared with the revolver. 2. The advantages and disadvantages of this particular arm as compared with the revolver. 3. The advantages and disadvantages of this pistol as compared with other automatic pistols. 4. The suitability of automatic pistols for the use of enlisted men. 5. If not deemed suitable for use by the enlisted men as a whole, would it be advisable to issue them for the use of officers and non-commissioned officers?

The results of this practical test will be of far-reaching importance, as they will determine whether our troops are to be armed with the latest development in the way of small arms or are to continue to use the old fashioned cylinder revolver.

At the recent tests of the pistol at the Springfield Armory thirty shots were fired from the Luger in about 15½ seconds, a rate of fire of 116 shots a minute. As the magazine holds but eight cartridges, this means that the magazine must have been replaced three times, starting with the arm loaded. This is double the rate of fire obtained from any other automatic pistol. The arm may be completely dismounted for cleaning in 3½ seconds.

The Luger pistol has been adopted by the Swiss government and the army of that country is now being supplied with the pistol from Berlin, but it is more than probable that if this government should adopt the weapon the rights to its manufacture will either be purchased outright or a royalty will be paid for its manufacture in this country, as was done with the Krag-Jorgensen rifle.—*Army & Navy Journal.*

TORPEDOES.

TORPEDO TUBES REMOVED FROM BRITISH CRUISERS.—The above-water torpedo tubes of the Grafton and Hawke have been removed, leaving only the submerged tubes. It is reported that all above-water tubes are to be removed from British ships as occasion offers.

ANTI-SUBMARINE ATTACK.—In the British navy considerable attention is directed towards plans for neutralizing or driving off submarine boats. In the opinion of many officers the best weapon to employ against the submarine boat is the spar torpedo worked from torpedo boats or large vedettes. Something can doubtless be done in this direction but a submarine boat is small and battleships and seagoing torpedo boats are large, and it may be difficult to "catch your hare." Furthermore, if a boat is near enough to use a spar torpedo effectively it would seem possible to use guns with deadly precision. If the submarine boat is too far submerged to be fired at she is not likely to be seen.

BOOK NOTICE.

The "Modern Seamanship" by Lieut. Commander Austin M. Knight, U. S. Navy, and published by D. Van Nostrand Co., New York, will be welcomed most warmly by the naval service and merchant marine—the need of a book on modern seamanship having been felt seriously for some years.

This book covers a wide field, is very complete,—and the science of seamanship for both steamers and sailing vessels is thoroughly outlined and clearly illustrated.

The title, "Modern Seamanship," is happily selected, for although the book contains all the information required for rigging and handling sailing vessels, yet its main features are devoted to steam vessels, and it contains all the information required by the modern seaman.

This book represents many months of incessant labor and research, as well as many years of practical experience, and the author deserves genuine congratulations upon this splendid treatise as the result of his work. The book is duly armed and fissured and will soon take standing as the American authority on modern seamanship.

E. W. E.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE COAST IN WARFARE

By LIEUTENANT-COMMANDER JAMES H. SEARS, U. S. Navy.

The material for this paper was largely gathered at the Naval War College in the shape of notes, which were drawn from many authorities to be found in the splendid professional library of that College. Quotations have been liberally resorted to and much of the text must, in addition, be credited to the numerous authors consulted. Originality has not been sought; on the contrary the effort has simply been to assemble in convenient form some of the best thought and opinion concerning a somewhat obscure and controversial subject.

The writer wishes to acknowledge the great assistance afforded by Lieut. B. W. Wells, Jr., who besides revising these notes supplied many suggestions that have been included.

PART I.

"War can be defined: The supreme appeal of right against the force which denies this right; whence the highest objective of war; to do the enemy the greatest possible harm. . . . If a

great king, philosopher and master of the art of war declares that riches are the sinews of war, all that strikes the enemy in his riches, à fortiori, all which attains this object even in the sources of his riches, becomes not only legitimate, but obligatory. We may expect therefore to see the battle fleets, mistresses of the sea, turn their power of attack and of destruction, lacking adversaries worthy of their steel, against all the cities of the Littoral, fortified or not fortified; peaceful or warlike; to burn them, to destroy them or at the least to bleed them without mercy. Through this new rôle and these new missions that logic imposes on battle fleets, we are about to enter into a new system of maritime war; that of the attack and defense of coasts."

This extract from the writings of a distinguished French writer, the founder of a powerful school of naval thought which has for a period profoundly influenced naval construction and which is still weighty in that direction,—whether it can be accepted or not, strongly draws the attention of naval people to a form taken by maritime warfare, a study of the peculiar operations of which has not been widely prevalent. In the body of the work from which the extract is taken, the assertion is flatly made that the probability exists that coast warfare and the guerre-de-course will be the main features in future maritime wars. To those who are at all familiar with the naval literature of the last hundred years, this modern statement comes as a reiteration of a traditional policy in naval warfare of the writer's nation, and will be readily recognized as an old friend; to subordinate the contest for the dominion of the seas to the procurement of ulterior objects; in other words the seeking of the object directly, disregarding the objective, the enemy's fleet, the destruction or dispersion of which, places that object at once in the hands of the victorious fleet. The statement is based upon a resumé of the operations of our Civil War; upon the absence of naval engagements in the Franco-Prussian war in 1870-71, and in the Russo-Turkish war.

It is assumed that the inferior naval power will shelter its fleets under fortifications, and that naval supremacy will, à priori, be at once established. It is sometimes, and in some quarters, taken as indicative of the same end that land warfare exhibits a tendency to return to the form of what has been called wars of position or of posts, as distinguished from wars of

marches,—such a warfare for instance as our War of Independence became towards its close. If the distinction exists upon the sea, then the coast warfare may be likened to the war of position,—and yet wars upon land are not characterized by a wholesale wanton destruction for ransom. The future of maritime war is dark and is fraught with tremendous possibilities, and it is best to acknowledge the permanence of coast warfare as a contingent or an integral portion of war upon the ocean,—not a thing of modern development, as the author assumes,—but it is not at once apparent that the conclusion is supported by sufficient grounds or argument. The undoubted facts derived from the wars used as examples, as in many other cases, may be used to support conclusions differing somewhat from those drawn. The error usually made in regard to the guerre-de-course of our Civil War is repeated by the author. The coast warfare during that struggle was called into existence by conditions happily, in our case, most unlikely to recur; and, in the Franco-Prussian war the contact of squadrons, the marine battles, were absent through a great complexity of causes, the course of the tremendous struggle in France most profoundly influencing the action or, more accurately speaking, the inaction of the fleets of the two nations. Not the least among the causes was the embargo placed by the Prussians upon their merchantmen in all parts of the world, thus removing largely any necessity for their inferior squadrons to keep the sea. A most significant fact connected with the wars in question and with the other wars of recent times, especially with the Crimean War, is that coast warfare either took place in the beginning, on the coasts of the power whose naval force was inferior to the point of impotence, or after that naval force had been reduced to impotence. Also, it is significant that there has been a marked abstention from acts of destruction or threats of destruction for the purpose of securing ransoms. In the Crimean War the question of fixed and mobile harbor defenses cropped up in England, but before long people recognized that the English coast line was being protected in the Baltic and Black Seas, and so the question lapsed. The northern coasts of this country from 1861 to 1865 were also secured by the blockading fleets on the southern coasts.

In the Franco-Prussian war we have the spectacle presented of

[illegible]

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the past; and if the duration of war has decreased, the time necessary to replace a battleship has vastly increased. The enormous value of a battleship will make its loss severely felt, and for this reason the risks will be greatly enhanced. As far as fortified positions are concerned, the power contemplating an attack upon them will be weighted with as grave considerations in the future as in the past. Such an attack, with or without the cooperation of land forces, has never been held other than as an extremely hazardous and delicate operation, warranted only by the magnitude of the material results to flow from its successful issue; while, on the other hand, the risks and losses in case of an unfortunate outcome have been equally taken into consideration. The successful squadron has been lauded throughout the world, even when the defenses and defenders have been of the most ignoble character; and it is another significant historical fact, worthy to be borne in mind, that the attacks of ships unsupported by landing forces in nearly every instance have been directed against the forces and the works of peoples far lower in the scale of civilization or preparedness than the attacking party.

In the present day, it may be said that the methods of attacking modern fortifications have scarcely been considered or tested. Other tactical problems have received more or less attention, this one but little, and it may be surmised that a squadron attempting such an attack will be obliged to submit to a very crucial test. Few seaports, if properly fortified, are of such importance that the reduction of their sea fronts would produce results commensurate with the risks undertaken by a fleet in making a direct attack. On our own seacoast, for instance, can it be stated that the possession by an enemy's fleet of any one port would be sufficiently decisive to warrant the exposure of a fleet of battleships to the certainly great losses it must suffer in the presence of modern fortifications, if operations of another character were open to it, and a hostile fleet still in existence? There may be a time in the course of wars when the balancing of advantages and risks will warrant such an undertaking. The opinion is not expressed that such operations will not be undertaken, but only that there is little to justify a belief that they can often produce decisive results, or will be resorted to more freely than heretofore. Concerning this aspect

of the subject, a Frenchman of another school justly says: "But let us suppose that the defense is decidedly inferior to the attack. In case of war between France and Italy, would the laying in ashes of Leghorn, Genoa, Palermo or Naples put the whole of the latter country at the mercy of the first? No, a thousand times no! no more than the ruin of Bordeaux, Havre, or Marseilles would force France to lay down her arms in the struggle for her existence. For, let it be remembered, a merciless war has this peculiarity: it inspires the weak with courage, a desperate courage, and not only courage, but a savage hatred and a thirst for revenge, from which several future generations will suffer."

Bases are essential to the operations of fleets, and it may be that bases in proximity to their fields of operation have acquired a new importance in these days of steam, for certainly battleships are not expected now-a-days to keep the sea in the manner of the old three-deckers. If the problem of coaling at sea be solved, there still remains to be considered the rapid deterioration of material due to mere complexity. But, in order to establish bases, fleets will not choose to attack strongly fortified positions, nor will it be to their interest to destroy the resources of the position occupied;—and it is not at all clear why fleets should put themselves into competition with formidable fortifications until, in combination with an army of invasion, a telling and decisive blow can be struck. A maxim of Napoleon's is worded thus: "Never do what an enemy wishes. One ought therefore to avoid the field of battle which he has studied, and as a consequence never attack in front a position which can be gained by turning." This maxim seems to be especially applicable to operations such as are under consideration, and its truthful bearing is borne out by the facts and experiences of all naval wars. A study of Admiral Colomb's writings on naval warfare should certainly establish its application in the mind of everyone, when direct operations against a fortified point are under consideration.

The *Army and Navy Gazette* of August 20, 1892, contains an extract bearing upon this point, as illustrated by the attack in the manoeuvres of the same year upon Belfast harbor and the works inside. The defenders were far inferior in numbers and in the matter of defense vessels, but the mine fields covering

them were very extensive and laid in double lines. The mine fields were also covered by flanking guns and search lights. The extract reads: "Considering the nature of what may be termed the second phase of the war, this result (referring to the large number of the attacking vessels claimed to have been put out of action) is not, perhaps, surprising; for it is extremely probable that in just such operations in actual warfare will the loss on both sides be very heavy. A question of importance is thus at once raised, is it expedient to engage in such operations as those which Admiral Fitzroy attempted, looking at the limited nature of the advantages likely to accrue from the ultimate success of the force undertaking the offensive, and the risks involved? In other words, is the game of attacking ports defended in the manner Belfast was assumed to be, worth the damage which the attacking force will probably sustain?" The action and condition of the inferior squadron were of a nature that can well be repeated when the manœuvres are not peaceful, and in one sense they are very pertinent to the subject of coast defense, and the line of strategic defense best calculated to insure coast defense. An inferior squadron was interposed between two detachments of the superior squadron. It is a very old situation—what the inferior squadron did in Belfast is well known, and the decision was against it. Without questioning the propriety of the attack made by the superior fleet, it may be useful to inquire if the Admiral of the inferior squadron did what was best for the one narrow and perhaps not vital issue—the defense of Belfast. The issue is here raised as to a point which will be referred to again. Rather than meet one detachment with the chance of disaster to himself, together with the certainty of inflicting great damage to the enemy's detachment, he placed his fleet in the position of a harbor defense flotilla. The question raised is one of policy. Is it wise to build with a view to such a defense, or to build with the view of defending the coast in another manner? It is not suggested that the defenses may not be materially strengthened by the presence of powerful vessels of types especially fitted for harbor defense; in many waters they may be invaluable,—but which shall we have first? The harbor defense vessel stands for so much naval strength; its value is taken from the total appropriation, and the line of battle is thereby weakened. Is there not, then, a minimum

naval strength which we should seek to attain,—a strength that would enable us to make an attempt at the naval defense which, historically considered, is deemed the best? That strength once reached, it then would be time to consider the question of the propriety of building such vessels. The opinion first quoted, which seems to have been rather generally entertained, goes farther towards clearing up the point as to the need of local protection by vessels when conditions are favorable for fixed defenses.

De Ruyter's action at Solebay, when his general position was not unlike the mimic one of Admiral Fitzroy, strategically considered, is worthy of being borne in mind. His squadron was inferior and his action was dictated by an immediate necessity for guarding the coast. Concerning it, and the results flowing from it, Captain Mahan says: "The allied fleets were to have assisted the operations of the French Army, by making a descent upon the coast of Zealand. De Ruyter's attack had inflicted an amount of damage, and caused an expenditure of ammunition, which postponed the sailing of the fleet for a month. It was a diversion not only important, but vital in the nearly desperate condition to which the United Provinces were reduced ashore. It may be added as an instructive comment on the theory of commerce destroying, that after this staggering check to the enemy's superior forces, de Ruyter met and convoyed safely to port a fleet of Dutch merchantmen." Captain Mahan further says concerning the general subject of the war: "For the allies to carry out their objects, and make any diversion upon the seaboard, or on the other hand, to cripple the sea resources of the hard pressed Provinces, it was necessary first to deal successfully with de Ruyter's fleet. The great Admiral and his government felt this, and took the resolution that 'the fleet should be posted in the passage of Schoneveldt, or a little farther south towards Ostend, to observe the enemy and, if attacked, or seeing the enemy's fleet disposed to make a descent upon the shores of the United Provinces, should resist vigorously, by opposing his designs and destroying his ships.' From this position, with good lookouts, any movements of the allies would be known. . . . After La Hogue, the direct military action of the allied navies was exerted in three principal ways; the first being in attacks upon

French ports, especially those in the channel and near Brest. They had rarely in view more than local injury and the destruction of shipping, particularly in the ports whence the French privateers issued; and although on some occasions the number of troops embarked was large, William proposed to himself little more than the diversion which such threats caused, by forcing Louis to take troops from the field for coast defense. It may be said generally of all these enterprises against the French coast, in this and later wars, that they effected little, and even as a diversion did not weaken the French armies to any great extent. If the French ports had been less well defended, or French waterways open into the heart of the country, like our own Chesapeake Bay and Delaware Bay and the Southern Sounds, the result might have been different."

Concerning this particular point raised in the last paragraph, it is well to note here, the prominent place which must be assigned to the navy in coast defense. These very waters perhaps are entirely indefensible by fixed defenses. Without a navy, they may in the future become, as in the past they did become, the scenes of war. The introduction into warfare of elements different from those existing at the time treated of by Captain Mahan, has placed other localities in the same category. Formerly, the occupation of the Lower Bay at New York was not a distinct menace to the interests above and beyond; the defense was good at the Narrows. To-day the defense should be pushed to the outer limits.

This Dutch war, the third great one of the 17th century, contains so many elements directly bearing upon the subject, that it will repay closer investigation. Considering the short space of time in which it took place, the restricted area covered by the operations, and the fact that the objectives of each side were not obscured by a mass of outside details, it is perhaps one of the best examples in history of how a navy, though an inferior one, accomplished the greatest good in national defense. There is no question of the character of the weapons used, nor of the tactical combinations developed, in the presence of the enemy. The valuable lesson is quite independent of all such considerations, and is to be found simply in the strategic uses of armed forces. Four great battles were fought, not one of them being deemed by contemporary English historians a vic-

tory in the ordinary tactical sense, and yet the Dutch fleets saved the nation. The whole course of this war bears testimony to the place of a navy in coast defense which it is impossible to disregard.

The French invaded Holland with 200,000 troops and were opposed with but 20,000 backed only by an inferior navy, diplomacy, and the dykes. The greatly superior naval force of the English and French in the four great drawn naval engagements was prevented from landing the troops and ravaging the coast through the desperate courage and the skill of the inferior Dutch fleet. The last battle, which took place off the Helder, was within a few miles of the shore and in the hearing of the people. Concerning this battle the contemporary English historian Ledlard naively says: "The Dutch made pretenses to the victory this time, with such assurance that they had publick rejoicings and thanksgivings on that account, and de Ruyter was, on this occasion, complimented with the title of Preserver of his Country. This latter may, indeed, in some measure, be said to be justifiable, because he had preserved his country from the intended invasion of the English: and if it may be called a victory, because the English were prevented in their intention, which, indeed, is the chief reason they ground their pretense to it upon, they are not altogether in the wrong; but for any other advantage it is apparent they had none."

The first battle, that of Solebay, was fought in June, 1672, with the one great result that the designs of the allies against the Dutch coast suffered a check. How was it in Holland itself? The biographer of de Ruyter tells us that the news of the battle was received two days later at the Hague, that in the beginning of June the land frontiers were attacked simultaneously in all parts by the three armies, the French, that of the Elector of Cologne, and that of the Bishop of Munster. The Dutch waited for news that the French had taken Utrecht and had penetrated to the heart of Holland. The greater number of the officers were without courage and without experience, the soldiers were seriously deficient in both qualities. Order was lacking, negligence was extreme, and dissensions were augmented. Moreover, an extraordinarily dry season had converted the great rivers, the natural ditches to the Dutch fortresses, into fordable streams, and the marshes and swamps that surrounded

many fortresses had become dry and hard,—Heaven and Earth seemed to conspire in every way to cause the downfall of a nation. Believing the time had absolutely arrived, and being strenuously urged by Pensioner de Witt, the people were disposed to use the means which they kept in hand for the last extremity, to raise the sluice gates, submerge the country, and concentrate every resource in Amsterdam for a last desperate defense. "Such was the state of affairs and dispositions of men's minds when the news arrived of the issue of the naval combat against the armies (naval) of the two kings. People were then compelled to acknowledge that the Providence of God had used these measures in order to preserve the Republic, for if the English and French together had been as happy by sea as the latter were by land, and that if the fleets of Holland had been beaten, there is no possible doubt that all would have been lost." Such was the influence of the first drawn naval battle. The French successes continued on the land frontier, and Utrecht and Naarden fell. All the Dutch commerce had been embargoed. The sluice gates were opened, and the country was now stripped for a death struggle.

De Ruyter studied the coast, searched out the places where a descent would be practicable, reinforced garrisons, and posted his fleet well inland and in a position to take every advantage as the opportunity offered. A council of war, convened by the Prince of Orange on his flagship, determined "with one voice that the fleet should remain at or near its present position (Schoneveldt)." One year after the battle of Solebay, de Ruyter put to sea in the presence of the superior allied fleet, and another drawn battle was fought. The biographer says: "It is certain that on one side the object at least was a descent on Holland or Zealand, and the destruction of the Dutch fleet if possible, on the other side the attempt was only to defend themselves, and to guarantee the coasts against invasion." This was certainly the result of the drawn battle. One week later de Ruyter put to sea and fought until after dark, and then reformed his fleet and headed N. W. to keep touch with the allied fleet,—but the next morning that fleet was not to be seen. The allies returned to the Thames, and de Ruyter to his post off the Schoneveldt, whence he declared to the Deputies "That it was necessary to post the fleet in the most advantageous

quarter of the Schoneveldt, in order to cover the coasts of the Provinces from the invasion of the enemy." The French now besieged Maestricht so closely that de Ruyter was directed to sail in order to create a diversion either on the French or the English coast. Maestricht fell before he sailed, but the plan was carried out. The English fleet sailed from the Thames, and the two fleets manœuvred for days in sight of each other without coming to action until de Ruyter learned that the design of the English was to draw him away from the Dutch coast, while an army of invasion could secretly be thrown into the country; where he returned and cruised along the coast until August, when the last great drawn battle was fought off the Helder,—the English returning to England as usual, and de Ruyter to the Texel to refit.

Other countries had come to the assistance of Holland, and the soldiers on the coast were free to return to the army, Naarden was easily retaken, then Borne,—followed by the evacuation of Woerden, Bommel, Utrecht, and finally of all the provinces. Preparations were made cheerfully by the Dutch for a campaign in the following spring, but the English government under compulsion of the people consented to a peace. This is the story in few words of this famous war, and there is no possible question but that de Ruyter with his fleet saved the Dutch nation. Without crushing his enemy or even inflicting a defeat of magnitude upon him, de Ruyter absolutely gained his object and frustrated that of the allies. The coasts were saved from serious attack, no cooperation of the allied fleets with the armies on shore was possible, while de Ruyter remained afloat with a concentrated fleet. It is difficult to see how any question in the modern development of ships and weapons can operate to change our ideas of the powerful influence that even an inferior fleet can exert in coast defense or of the proper handling and disposition of naval forces in such defense.

Coast raiding, in whatever form it may take, is a different thing. The risks are small, the results considerable, and it will continue to be resorted to freely in maritime warfare Cruisers may act as commerce destroyers or raiders, according to which method of action gives the better returns with the lesser risks. At any rate, the cruisers, before being ultimately

destroyed, stand a good chance of paying for themselves. During the War of 1812, nearly the entire Atlantic coast and the Chesapeake Bay shores were subjected to ravage, and their coast villages plundered and burned. It may have paid, and the risks were certainly small, though no appreciable effect was produced upon the course of the war. The other operations on the coast were of the nature of coups-de-main which took no concern of fortifications, with the exception of the Baltimore affair.

The direct serious operations of a fleet upon a coast rarely have been regarded as having any decisive result upon the course of a war in which they form a feature, even though undertaken with all the guarantees that have been offered by the temporary or, even more far reaching, habitual command of the sea. Blockade of the enemy's vessels or his commerce, observation of the enemy, contact of fleets, or the support, transport, and sustenance of an army, constitute far more effectual and direct operations for a navy, and conduce more to accomplish the desired result.

The limited field of action of naval forces was well understood by Mr. Pitt, who, in 1794, in supporting the increase of the English land forces, subsequent to the failure of the Dunkirk expedition, said: "The power of Great Britain at sea, however irresistible on that element, could not, in the nature of things, make an adequate impression upon the enemy, whose whole strength was concentrated on land; and who, for that reason, could there only, be assailed with efficacy. It was only to prevent the invasion of the territories of their neighbors, that the war against the French had been undertaken."

This limitation of the powers of a fleet may have been one among the many causes of the failure of the English in the War of Independence. In the absence of a defensive flotilla, the Atlantic coast of the United States presents a theatre singularly favorable for the offensive action of fleets. The series of events in which Lord Howe and d'Estaing figured between New York, Newport, and Boston is too conclusive to be lost sight of as to the influence of a flotilla on the defense in preventing territorial attacks, and as to the relations existing between fixed and floating defenses.

Leaving the Delaware on June 28, 1778, Lord Howe arrived off Sandy Hook on the day following and was met by a

packet express from England, the Grantham, with the intelligence, dated May 2, of the departure from Toulon on April 13, of a squadron destined for American waters,—and, also, that his own fleet would be reinforced by Vice-Admiral Byron with thirteen vessels, which force sailed from England for Halifax on June 12. The British government acting upon the information of the sailing of d'Estaing had directed Sir Henry Clinton to evacuate Philadelphia, and after accomplishing the evacuation, he reached the Jersey Highlands on June 30, with the Continental army hanging close upon his rear. Howe extended every aid to get the army on to the Hook and thence to New York, and accomplished the transfer by the 5th of July. The vessels from New York under Commodore Hotham joined the squadron on the 7th, two days later, and at this time Howe by a letter of marque received positive intelligence that the vessels of d'Estaing's squadron had been seen off the Virginia coast, and later at anchor in the Delaware. Still later it was known that d'Estaing was approaching New York, the force under his command consisting of twelve sail of two decks and several frigates. The vessels were, one of 90, one of 80, six of 74, three of 64,—the smallest frigate carrying 36 guns. The total complement was about 11,000 men, of whom 1548 were soldiers. At noon on the 11th, a lookout frigate signaled the news of the anchorage of the French off Shrewsbury Inlet, about four miles below the neck of the Hook. Lord Howe's total force consisted of six sail of the line of 64, three of 50, two of 40, with some frigates and sloops. The cause of d'Estaing's appearance is to be found in the battle of Germantown and in Burgoyne's surrender, which turned the scale in the wavering minds of the French,—and as a result, the treaty of alliance was signed February 6, 1778. On the 15th of April, 1778, d'Estaing sailed from Toulon and on the 8th of July he reached the Delaware capes. It has been said that his time was unnecessarily slow, but it does not appear that this opinion is wholly justified. Four weeks were occupied in reaching the straits, leaving eight weeks for the passage across the Atlantic. Vessels now-a-days at that season of the year, sometimes take as much time, and the speed of a fleet is regulated by that of the slowest element. Nelson's average speed in pursuit of Villeneuve was but three knots per hour. At that rate,

d'Estaing would have taken sixty-one days, and Chevalier states that two of d'Estaing's fleet were such poor sailers that they kept the whole fleet back. The four weeks between Toulon and Gibraltar was also a matter of not uncommon occurrence.

On the approach of the French fleet Howe was busily engaged in preparing for sea, with a view to forming a junction with Byron, or to be ready for any emergency. Lookout service was efficiently performed by volunteers in light draft coasting vessels. A considerable part of the fleet, including the flagship, was at Staten Island taking in water, when the news was received of the proximity of the French. Howe at once proceeded in his barge to the Hook, expecting that d'Estaing would not hesitate an instant to avail of what seemed to him a great opportunity thrown in his way of overhauling a detachment of the British fleet at anchor. D'Estaing in the uncertainty caused by the doubts of his pilots, who were the best on the coast, passed several days in sounding the bar; and this gave a breathing spell to Howe, of which he made good use. Howe caused soundings to be made and the currents studied, and he made the most careful and skillful preparations to receive an attack however delivered. The British fleet was moored head and stern, concave to the channel of entrance around the Hook,—the gap nearest the extremity of the spit being filled by an armed transport, the Leviathan. On shore two batteries, one of two howitzers and the other of three 18 pounders, were thrown up on the prolongation of the line, and four regiments under Colonel O'Hara were landed to dispute any possible attempt on the part of the French to land. The other extremity of the line left perhaps the space of a mile between it and the S. W. spit. Some frigates were held in rear for incidental service, and a double line of frigates and rowing gun vessels was thrown forward towards the bar. The outer line was to receive the first of the attack and undertake to throw the French into confusion. The inner line was to fight under oars, and gradually to withdraw over the shoals where it could not be approached by any but the smallest vessels. The vessels of the line at anchor were moored with their heads towards the Hook, and the moorings on the port quarters would enable the broadsides to be sprung in every direction that the channel would permit the enemy to take. No possible improvement

would seem to suggest itself upon Lord Howe's arrangements. His line could not be pierced; and could only be doubled at the inner end, but not until after the enemy had been under the continued concentrated fire of every vessel in the three lines and the Hook batteries. On the 22d, five days only before the battle of Ushant, d'Estaing weighed in a fresh N. E. breeze at 8 A. M., and reached to windward, apparently with the object of obtaining a weatherly position for entering. In the afternoon, the spring tides running, the water was thirty feet on the bar. At 3 P. M. the French fleet had borne up to the southward. It was supposed that d'Estaing had not abandoned the attempt, but fearing an easterly gale in an exposed position on a lee shore, had put to sea for room. In the next few days, the vessels of Byron's squadron which had been dispersed in a gale began to arrive, and, of course, in the absence of the French they went to the reinforcement of Howe.

It is but fair to let d'Estaing speak for himself of his failure to crush the squadron of Howe:

"Both officers and crew were kept in spirits . . . by the desire of delivering America from the English colors, which we saw waving, on the other side of a single barrier of sand, upon so great a crowd of masts. The pilots procured by Colonels Lawrence and Hamilton (under Washington's direction) destroyed all illusion. These experienced persons all unanimously declared that it was impossible to carry us in. I offered a reward of 50,000 crowns to any one who would promise success. All refused, and the particular soundings which I caused to be taken myself too well demonstrated that they were right."*

Howe received information of the appearance of the French before Newport and of their dispositions in the three entrances to Narragansett Bay, by which he was encouraged to believe that he could oppose his force to detachments of the French fleet. Wind and tide however not making favorably and together, it was the 6th of August before he got away from New York, and the evening of the 9th before he reached Point Judith, where he anchored. The lookout frigate reported the enemy at anchor inside, the entrance having been made under the fire of the shore batteries on the 8th. By way of Brenton's

* d'Estaing to Congress.

Point, Howe received exact information of the enemy's dispositions. D'Estaing had arrived off the harbor on the 29th of July, and had sent two ships in by way of the western passage, which passage they forced under a crossing fire by batteries on the southern extremity of Conanicut Island, and the western shore, at Bonnet Point. The successful entrance of these vessels caused the abandonment of the batteries on Conanicut Island, and the burning and sinking of vessels in the harbor, mounting in all 212 guns. It was, as before stated, only on the 8th of August that the main fleet was taken inside under fire, and on the next day 4,000 sailors and soldiers were landed on the upper part of Rhode Island to augment Sullivan's forces of 10,000. The entrance of the fleet also caused the English to narrow their lines of defense and concentrate above Newport.

When Howe's fleet was reported to d'Estaing, he recalled his 4000 men, and on the 10th with a wind fair out of the entrance sailed with his whole force. Howe's biographer, Barrow, states that at this juncture, the British fleet was superior by 12 guns, but that the odds in weight of metal were against it and in favor of the French. It was Howe's opinion that he could not venture to attack the French within the harbor; and if we recall the situation in front of New York, where d'Estaing confronted a sand bar, and every gun hostile, and contrast it with the position at Newport, with plenty of water and the batteries of one shore friendly, it will perhaps appear that Howe escaped condemnation in his turn only by the sally of the French. Outside, both fleets were terribly handled by a gale and dispersed without coming to a decisive engagement,—Howe's fleet being reunited at Sandy Hook, while that of d'Estaing returned once more to Brenton's point on the 20th of August. Learning of this fact, Howe made all sail to come up with him, but the bird had flown, and on the 1st of September Howe got sight of him anchored in Nantasket roads, and well disposed for defense under batteries thrown up on friendly islands. Again the opportunity to attack is foregone, the position of the French being deemed one of great strength. Before the English were strong enough to shut up the French they got away in a snow storm for the West Indies, and Sullivan had withdrawn from Rhode Island.

In this series of operations,—all occurring directly on the coast line and therefore more closely marking the intimate rela-

tion between coast defense and a mobile force than when operations in the open sea are carried on, although coast defense may be none the less secured by such actions,—we see a fleet three times posted under fixed defenses awaiting an attack which for tactical reasons is not delivered. Tactical lessons, then, from these situations can only bear upon the various dispositions for defense that were introduced. In another sense however there can clearly be seen indications of value in some respects as to how a fleet can best be used to promote either coast attack or coast defense. Let us put plainly before us the military situation on the coast. The threat of d'Estaing's force had compelled a concentration of the British at New York. Rhode Island was also held by the English, while Boston was and had been American. In the time of these movements as described, then, the English were strictly on the defensive, while the designs of the Americans supported by the French Fleet and soldiers were strictly offensive.

D'Estaing's orders contemplated a general support of the American armies, but first of all, aided by secrecy he was to fall upon Howe's inferior fleet and transports in the Delaware. Paul Jones in a memorial had urged this action on the Court of Versailles previous to d'Estaing's departure. The evacuation of Philadelphia may be taken as a sign of a feeling of weakness in the English ranks, and if d'Estaing had come up with Howe either in the Delaware or at sea, it is more than likely that Howe, encumbered and inferior as he was, would have been beaten, and in consequence New York, invested on all sides by Washington's army and the French fleet, would have fallen. D'Estaing's arrival being too late for this decisive action, Washington left it to d'Estaing whether to cooperate in the attack on New York or on Newport. Washington planned to act upon the choice of either, and prepared for the augmentation of Sullivan's army in Rhode Island by raising militia which he was empowered to do, and by holding regulars in hand to be sent overland from about New York, the water passage though desirable being dangerous because of the English cruisers.

When d'Estaing determined to abandon the attempt on New York, there remained open to him two alternatives in the use of his fleet: to proceed as he did or to block up Howe's fleet in New York Bay with his whole fleet or a portion of it, detaching

the remainder for the reinforcement of Sullivan or for the purpose of informing Sullivan of his predicament. Finding Howe so strongly posted, the strategic situation had materially changed from the conditions under which Sullivan had been induced to look for the French assistance. Was the American cause better furthered by holding Howe impotent and with a chance of overcoming him, or by proceeding to the aid of a territorial attack, not yet fully concerted, which was certain to be interrupted by what has always been sufficient to interrupt such attacks,—even an inferior fleet? The dilemma of d'Estaing was aggravated by the fact that though aware of Byron's approach, he did not know of the dispersed condition of his force, and, feared to be caught between two hostile fleets off New York,—yet the key of the whole situation was one or the other of these fleets, or both. By informing Sullivan and holding Howe he could by means of lookouts have had ample news of Byron's condition and approach; and by having observing vessels in front of New York, Byron could have been dealt with. By leaving New York, d'Estaing surely invited the course of events which followed, and deliberately abandoned the one chance of success. Howe's great personal energy and the good will of the whole fleet, enabled him, by simply appearing before Newport, to save the place,—and the pages of history are full of records to the effect that a territorial attack is powerless until the interfering naval force is disposed of. When Howe appeared, it was imperative that d'Estaing should embark his 4000 sailors and soldiers, and then he was in the same position as when before New York, with the exception that Howe was at sea with about an equal force and did not intend to lose touch with the French, but to require the final settlement to be between the naval forces. D'Estaing here, it seems, seized the right conception, but if there had been a battle and d'Estaing victorious, Howe's use of the inferior force would still have saved Newport or at least gained time, for d'Estaing's condition would undoubtedly have forbidden the immediate prosecution of the designs against Newport, (the injuries caused by the gale having forced him to go to Boston to refit) and the English government would have been fully aroused to the need of augmenting the forces on the American coast.

D'Estaing left for the West Indies, eventually, under the threat of the now superior English forces.

The advantages conferred by his visit are thus stated by Chevalier: "The attitude of the Versailles cabinet had called the attention of the English ministry to the dangers to which Howe was exposed, and in giving him orders to leave his position the Court of London had been obliged to decree the evacuation of Philadelphia, since Clinton's army could not sustain itself without the fleet: it is therefore exact to say that this result was entirely due to the French alliance. . . . The arrival of Lieutenant General d'Estaing had, while increasing the confidence of the Congress in the ultimate success of the insurrection, deprived the English Commissioners of all hope in their mission. The corvette Stanley, the corsairs Rose and Fanny and eighteen merchant vessels had been captured by our ships. The York sloop had fallen into our hands, but was retaken by the English. The Mermaid frigate of 28 upon the point of being engaged by the Fantasque and the Saggitaire was wrecked upon the coast on the 8th of July at the mouth of the Delaware. At Rhode Island, the Grand Duke frigate of 40, the Larck, Juno and Flora frigates of 32, the Cerberus of 28, the King Fisher and Falcon corvettes and other smaller vessels were burnt or sunk by the English. The Senegal corvette, and a bomb vessel were captured by our frigates subsequent to the gale of the 11th of August."

In October, 1779, the British evacuated Newport under the threat of d'Estaing's reappearance upon the coast, and concentrated for the defense of New York. Previous to the evacuation Washington wrote to d'Estaing: "Success in this attempt (upon Rhode Island) would be favorable to our ulterior operations against New York, but a failure would be attended with the reverse, as it would damp the spirits of the country and diminish its exertions. Another inconvenience would attend it, which is, that, without a division of your force to continue the blockade of New York, the fleet now there would make its escape. Indeed, in any plan a division would be indispensable. Rhode Island and the Sound must be blockaded otherwise the garrison there will form a junction with the main body at New York, which would be so great an accession of force, as would render the success of our operations impossible. . . . In case of the attempt upon Rhode Island, the only expedient to avoid a division of your ships of the line, will be to remain with the

whole at New York, and send your troops around under protection of your frigates." There existed no practical difference in conditions to have rendered this advice less applicable fourteen months earlier than it was when it was written.

Opinions differed in former days as to the use of fleets, and an officer who accompanied the expedition of Ross and Packenham which burned Washington and was beaten at New Orleans, afterwards wrote a book in which some tactical opinions appeared. These opinions gained considerable vogue and were skilfully used to support the doctrine of the efficacy of coast warfare. The author says: "To penetrate up the country amid pathless forests, and boundless deserts, and to aim at permanent conquests is out of the question. America must be assaulted only on her coasts; her harbors destroyed; her shipping burned, and her seaport towns laid waste, are the only evils which she has reason to dread; and were a sufficient force embarked with these orders, no American war would be of long continuance."

No one is inclined to question the fact that steam and the development of speed and long range ordnance have conferred a great power of offense upon vessels by enabling them to take the sea quickly and fall suddenly upon various points of the coast line. Cruisers are especially adapted to such a warfare. They can appear before ports without warning; they can commit what depredations they choose, or they can levy a heavy ransom. Their long range ordnance will be effective against exposed mercantile ports, while they themselves enjoy considable immunity. So long as they retain their speed and keep their coal bunkers full, they have little to fear. It is however, open to grave question whether steam with its numerous advantages has made the maritime siege of a seaport any the easier in execution or more certain of success than was the case in the days of sail. In those days serious attacks upon fortified positions were made only after due preparation, the attacking force and its accessories being properly proportioned to the contemplated operation. The preparation once completed, however, the fleet was able to maintain itself in position for a considerable period with no great difficulty, even though the contingent base was not close at hand in point of time. The necessity at present for greater care, in the expenditure of ammunition, owing to the relatively few rounds carried, and the

rapidity with which it can be exhausted, does not lessen the comparative difficulties in such operations.*

Coast warfare has always accompanied maritime warfare, and as the relative powers of navies engaged in such wars have varied in the past, as in the present, no argument can be drawn from the tendency nowadays towards an equalization of the strength of navies or towards the supremacy of one or more navies.

The question of coast defense is a vital one to any maritime power, or to one with a maritime frontier. The expenditures required to fortify a coast properly, are enormous; and this fact alone demands that the subject shoud be carefully studied, that the expenditures may be properly applied. There is no theory so false as the one that calls for the utilization of means or schemes, however effective, without regard to cost; for upon that theory, the revenue of a government might be wasted in arming the coast at all points. It is true, the coast might be protected, but it would not be any the better protected than by a system founded upon the study of the needs of coast defense, and it is needless to say that no government with such a coast line as our own is rich enough to enter upon such a course. If it were a matter of demonstration or experience that a continuous front of defenses on the coast or at every opening, would guarantee its integrity, it might be well to adopt that line as a standard, were it in any degree within the range of possibility to completely develop it. But such is not the case.

In a few respects there is considerable likeness existing between a land front and a seacoast. The land front *may be* a natural line of defense; the seacoast *is* a natural line of defense. Continuous lines of fortifications on a land front, strengthened at strategic points, have long been abandoned,—they could not be held at all points, and never fulfilled the expectations to which they gave rise. Were it within the limits of possibility to provide every opening in the coast line with fortifications,

* At Alexandria, the ammunition of the English vessels ran dangerously low, especially that of the Sultan, which was reported to have been within an hour of complete exhaustion. The bombardment would have been an impossibility, if there had been any chance that the fleet might have had a mobile, even though inferior force, to encounter afterwards.

the enemy could, from the impossibility of garrisoning every such point, land upon the coast and open the way by a coup de main;—and we cannot too often recall the experiences of the Southerners who, at the expense of the armies in the field, made the attempt to furnish every available port of their coast line with fixed defenses and garrisons.

Frequently for military purposes a seacoast has been compared with a mountain range which can be passed at a few points only, the remainder of the front being generally impassable. The passes and harbors are strategic points, and indicate clearly the locations for fortifications. In the case of a mountain range, the passes are few, and the enemy is compelled to attempt them unless they can be turned. On a seacoast such as our own, the roads are many, and it is conceivable that the objects sought in coast defense are different, while there may exist also a wide difference in the objects to be obtained by coast defense by the various nations. These objects themselves are distinguished, one from another, by two distinct sets of considerations, one depending upon the nature and composition of any probable attack; the other upon the best means of defense available, flowing from the condition or state of the nation which would cause one method of attack to be the more easily repulsed than another. For instance, the form of attack known as invasion cannot be contemplated by Englishmen with calmness; whereas, there is no country where invasion could be so surely repulsed as our own, and where it should be so little dreaded; and if the attack upon our arsenals, wealthy cities, and other strategic points can be made to assume, on account of fortifications, a risk not commensurate with the results even in case of success, then it seems that the mission of seacoast fortifications will be fulfilled. The attack being averted, the enemy will be forced to let his offensive operations take some other form, blockade perhaps, or invasion. The first can be interfered with *only by a navy or the mobile defense*, while the second cannot be prevented in the beginning, but can be made disastrous to the force undertaking it; and neither can be seriously undertaken *while a navy is in existence free to act in opposition.*

Since 1826, it has been constantly asserted in some quarters that war could only be excluded from our territory by fortifications, and that we could only assume the offensive through our

navy; but it is not certain that there is anything in history to show that seacoast fortifications ever excluded war from territory, while history is replete with examples to show the influence of a navy in that direction.

In another sense, the dread of invasion of this country should not bear very heavily upon us, with but one nation bordering our own so closely as to render the operation in any degree easy of execution,—and in the case of England, the operation of invasion could be made to work both ways. Basing her power, however, on Halifax, Bermuda, Nassau, and the Antilles in the Atlantic, and upon Esquimault and Guadeloupe, perhaps, in the Pacific, she is sufficiently provided with contingent bases so necessary to the success of such an operation, or in fact to the success of any operation over the sea. The first requirement for extensive operations would be a base near the intended point of attack.

It is a singular fact that military or naval people have not yet determined with exactness the amount of tonnage required to transport a given army corps, with or without all the necessary equipage. For instance; for an army corps of 75,000 men, for a short trip across the North Sea or the Channel, the estimate of the number of vessels required for its transport is variously given as from 200 to 500, vessels of the same size being under consideration; and when regarded by tons per man, the estimate varies from three to five or six tons. It is sufficiently apparent, however, that for the transport of an army of invasion of the size absolutely demanded under the modern conditions which so greatly favor concentration for resistance, an enormous tonnage would be required even for a short trip of a few miles, and in addition, the covering fleet would require to be fully the equal, and probably greatly the superior in strength to the opposing navy. In an expedition of sufficient magnitude to approximate success, extending over the Atlantic Ocean, the transport would need to be so numerous that its clumsiness and vulnerability can well be imagined.

It has been somewhere stated that the estimate in 1878 for the Russian transport displacement in the Black Sea, called for five tons for an officer, one ton for a soldier, four tons for a horse, and eight tons for a vehicle.

Broadly speaking, a natural line of defense is one that furnishes, in its geographic and physical features, obstacles that in themselves facilitate defense, be it in preventing the forward movement of an enemy, or in enabling a smaller number of defenders to meet him on equal or favorable terms. The defense in a mountainous district bends its efforts to the passes, but in its rear should be a concentrated force ready to attack such columns as succeed in penetrating before time is given to deploy. Ships alone when successful over coast fortifications are not liable to such an attack, except in the common case offered by a river or by a harbor having a long narrow entrance,—in which case the passive defenses should be as efficient after the passage is forced, as at first. At the passage of the Mississippi, between forts St. Philip and Jackson, if the line of defense had not been limited to the line between the forts, but had also provided for a strong resistance in rear, with sufficient batteries posted in favorable positions on either bank, the defense would have been more rational. At Charleston, a defense equally strong with that of the outer line was provided in rear. Sullivan's Island, which amounted to one large fortified position, though its main strength was improvised, was intact throughout the siege, and on the inner lines of the defense were posted some of the heaviest guns, which never came into action.

In the Mississippi, this second line of defense was desperately held by a few vessels, which inflicted as much, if not more damage than the forts; but the line was not sufficient, and the flotilla suffered, as always, the fate of the inferior in numbers,—but the temper and skill of the antagonists were equal.

The geographic land frontier, if not forming a natural line of defense, that is, if not characterized by mountains, lakes, rivers, or deserts, will be abandoned as a line of defense, and one will be taken up more in the rear, or perhaps in advance. The sea frontier, a geographic frontier as well, must be held against ships, but the line of defense against invasion may be withdrawn, if it is not maintained at the landing point. The parts of a sea frontier that facilitate landing, possess more the character of plains; and battles between armies at such points may profoundly influence the pending conflict, and perhaps give rise to decisive results. The first battles fought by the invaders, as at Vimeira in Portugal, the Alma in the Crimea,

or recently that of Concon in Chile, were cases in point of vital importance. Certainly in the last two, had the results turned the other way, they would have been decisive conflicts; and Wellington at Vimeira was fully prepared for a repulse that would have compelled him to re-embark.

If the land frontier of a country is characterized by a desert, the natural defense is very perfect indeed. The obstacles to be passed are far more prohibitive than those offered either by a chain of mountains or by the sea. The position of the Chilean Revolutionists in the Northern Provinces, in 1891, separated by a desert from their enemies, has been termed insular, but the word is not strong enough; their position was such that they could be assailed only upon one side, upon the single sea frontier.

On a seacoast, while the harbors may, in a sense, be likened to the outlets of mountain passes, the passes themselves are unknown. When an attacking or invading force has left its base unnoticed, its course is known only to itself, until it appears in front of its objective; and then from its mobility, it can choose another,—the defenders still being in ignorance of the point of attack. These considerations and the use of steam, greatly favor the attack; but the greater number of men required for an invasion at the present day, the extent of the equipment, the telegraph and railroad, together with the torpedo boat and lookout vessel, have still farther favored the defense. Concentration by rail in superior force over the greater part of this country should well be accomplished during the disembarkation of the enemy.

Periodically, a scheme comes to the front, usually backed by influential opinion, which is to revolutionize all existing ideas of national defense. The torpedo was to have done that,—and while it may yet do so, the conservative well-balanced opinion only looks upon the torpedo as one element, though a most valuable one, of defense. General Paixhans, with his guns and shells, thought that there would be no more costly line-of-battle ships; only smaller inexpensive vessels not larger than frigates, carrying his ordnance. Sir Wm. Congreve fully believed that his rockets would replace artillery,—and so with the ram. Balloons dropping tons of high explosives may render useless other costly schemes, and in the Franco-Prussian war an ingen-

ious inventor planned to crush the Emperor, Bismarck, and Von Moltke by dropping three or four tons of iron down on them.

The subject of coast defense, or harbor defense more strictly speaking, has received frequent and fortuitous treatment at the hands of army engineers, who possess the great merit in their discussions and conclusions of agreeing closely among themselves upon the point at issue. There is little or nothing to be said in opposition to their conception of the strategic or tactical problems involved, or to their clear understanding of the means to be used. The amounts requested for the purposes of fortifications are not excessive, when the enormous extent of coast and the numerous inlets are taken into consideration; and the whole system of national defense, military and naval, goes forward as a well-studied and harmonious whole. The subject has, however, been more frequently presented from the military point of view. While not intending, nor attempting any criticism whatever,—there being no reason for any,—the matter may be viewed from a standpoint having a little different perspective. As might be expected, in England and France, where great fleets are maintained, the question of coast defense is a lively issue, and receives in every way the fullest and freest discussion. In other countries of the Continent of Europe, the course of coast defense marches on in its allotted place, in a perfected scheme of national defense, admitting only of modifications, as changes and improvements in material make themselves felt through the test of experiment or actual experience.

In England the coast is remarkably well defended, though the question of coast defense, generally, is the subject of a great amount of discussion. The division of control of its different parts is the same as with us: the permanent defenses and the submarine system being in the hands of the Engineers and Artillery. The mobile defense consists of the older ironclads, and vessels that have been laid on the shelf, together with gunboats and torpedo boat flotillas and their accessories in the way of depot ships, and countermining arrangements.

The development of the German Empire as a modern naval power furnishes an example that is perhaps unique on account of the short space of time which that development has required, and in the harmonious progress of all the means of offense and

defense. One idea has been taken as a basis and has been clung to throughout and developed consistently. The navy has not been built and then its base provided for, nor has the coast been fortified at the expense of the mobile forces. The security of the coast line has been taken as the starting point, and naval development has been projected outward from that starting point, while military development on the coast equally projected inward. There has been no hesitation, no going backward, no lapse in the scheme. While some other nations have offered the spectacle of not knowing or appearing to know in what way they should best proceed, with their policies undergoing annual changes so that in the end, instead of being strong in all directions, the military situation exhibits undue development in some directions and an equal contraction in others,—Germany has shown an equal and coordinate growth throughout. Her geographic situation and her form of government are to be credited of course with this satisfactory condition of things, and unlike England for example, her naval strength has not been absolutely essential hitherto to her existence, but has grown gradually as the necessity has arisen. Little is heard from German sources of disputes as to the relative importance of fixed defenses, garrisons, and naval forces,—the importance of each being recognized and each receiving its own share of government support. Coincident with the grand annual manœuvres, the coast defenses are placed on a war footing, when every detail provided for the emergency of war is carefully tested, i. e., the military roads and telegraphs, semaphore stations, search lights, submarine mines, signaling, supplies of ammunition, and gun exercise.

The safety of the remarkable coast line of Italy is provided for by heavy fortifications at the important strategic points and by the large ironclads which she has built. One definition or cause for their existence, as given by an Italian Admiral, is that, owing to the broken nature of the coast and the consequent difficulty of adequately providing it with fortifications, these vessels were to fulfill the functions of movable forts, the depth of water favoring their use in that manner. Taranto, at the southern end of the peninsula, is being made into a fortified point of the first rank, and it is a most valuable one, controlling the communications by water from either side, and forming a point of support between Spezzia and Venice.

Up to 1877 or 1878, the fundamental idea underlying the construction of the great Italian ironclads was that they were to be used in local coast defenses, floating fortresses as it were. The peculiar nature of the coast, its accessibility to attacks from the sea,—as landings can be effected at nearly all points,—and the railroads also lying along the shore, render it extremely difficult to provide for a national defense by means of fortifications. Since that date, however, the idea has changed, and the Italians now recognize that their best defense is in a fleet acting with points of support secured to it by fixed defenses. The change to this idea, and its development, is reflected in the course of her naval construction, and the formidable nature of the fortifications at a few well chosen places.

In general, the power contemplating the contingency that may deprive it of its naval defense turns in advance to the fortifications of its sea frontiers as its main stay for protection against the stroke for which that deprivation will have laid it open,—on the other hand, the power contemplating the desirability of such command of the sea as to enable it in the end to throttle the naval power opposed to it, unduly deprecates, in theory, mere permanent coast defenses, forgetful as well that in the course of such operations on the sea the enemy has frequently found its opportunities for retaliation, however hampered he may be by the disputed command of the sea.

A proper reading of principles would establish more just relations between the parts which go to make up the coast defense of a nation; and we should not see people clamoring for absolute invulnerability to be conferred by permanent defenses alone, nor others again, demanding the entrusting of the integrity of the nation to the single hand of the navy. Further, there would be less of the illogical demands that are frequently heard in this country, as well as in others, for the localizing of naval vessels; or of the prevalent belief that a navy is intended to take part in the defense of the coast as a present actual factor of harbor defenses.

In England, the discussions between the extreme thinkers, both naval and military, have taken on a somewhat warm character, which happily has given to the opposing views the clearest exposition; although in the heat of the argument the theories have sometimes been pushed to rather extreme limits

on both sides. Coast defense from the naval point of view in England finds itself primarily best insured in the augmentation of the sea-keeping navy. The method of defending the coast by the navy, and its true function and position in coast defense in the broadest sense, have been so ably laid down by Captain Mahan that his words are quoted, as they tersely and graphically exhibit that position and at the same time expose the weakness in the extreme naval argument. The principles are familiar by this time, but they acquire a new interest in their practical connection with coast defenses, meaning, in this case, everything which goes to protect a coast save the fleet, including all defenses, permanent or mobile. In discussing the naval policy of Great Britian in the earliest years of the century and in the closing years of the last century, Captain Mahan says: "But the widely scattered dominions of Great Britain offered many points besides the British Islands themselves to the blow of an enemy, and the navy had to protect not merely the heart, but the extremities, each and all of which were threatened in proportion to their value and their means of resistance when a hostile squadron was loose upon the sea. How then should this service be performed? By dividing the fleet among the points threatened, and establishing the line of defense close before the region to be defended? Not so should the true maxim, that the British navy was the first line of defense, have been interpreted. As in all military campaigns, the front of operations of a powerful fleet should be pushed as far towards the enemy as is consistent with the mutual support of the various detachments, and with secure communication with their base. By so doing, not only are the great national interests placed more remote from the alarms of war, but the use of the region behind the front of operations, in this case the sea, is secured to the power that can afford to maintain its fighting line close to the enemy's position."

"Not merely to check great combinations threatening great disasters, but to protect as far as possible minor but important interests, and for the security of commerce itself, the true station for the British fleets superior in temper, if not in numbers to the enemy, was before the hostile ports, and as close to them as might be. Then, though their function was defensive . . . they were ever ready, did opportunity offer, to

assume the offensive." And again he says: "A nicely coordinated system of defense does not contemplate that every point is to hold out indefinitely, but only for such time as may be necessary to receive the support which the other points of the whole are intended to supply. That the navy is the first line of defense, both in order and importance, by no means implies that there is, or should be, no other."

The naval extremists in England, while pushing their belief in the inadequacy of fortifications to fulfill any useful rôle in coast defense, provided their fleet is maintained at the strength they are ready to specify for it, on the other hand insist that any lessened naval strength can gain nothing from fortifications; for, as one of them puts it, the first gun fired in England, in anger, upon the coast is the signal for the downfall of the Empire. They support their position brilliantly and stoutly, they point to history to sustain and corroborate their views, and with such ability that, with the natural predilections of naval officers, it is easy to go with them in their argument, so far at least as England is concerned. While their words would seem to convey the meaning that they are opposed to all fortifications for the defense of the coast, or of the interior, they appear to be carried that far simply through a certain logical tendency of their arguments. If looked at as a question of cost, or precedence in the matter of expenditure, it would be impossible, if not criminal, to say that any object for national defense should be for a moment considered by English statesmen, while the fleet fell short of the standard that conditions absolutely impose upon it, and which, in threatening periods of the history of England have repeatedly been imposed upon it.

Sir John Colomb has wittily expressed a portion of this policy by calling attention to the fact that a cat does not go looking all over the house for a mouse, nor stay by the stove, but sits down in front of the hole and stays there till the mouse comes out.

If, as claimed by these radicals, their navy should be maintained in such a state of superiority that it alone can at all times prevent invasion or insult to the coast, in the complete application of the principle of fighting out the struggle on the enemy's coast; and further, if it be true as claimed that, with the loss of such naval superiority, or the ability to protect the coast by

naval means. England can be starved into submission without the firing of a hostile gun on the coast,—it then can be argued that the expenditure of one pound on coast defenses for those islands, until the fleet is in such a state of superiority, would be a gross waste of revenues.

England has, however, been subject to invasions and attempts at invasion, and it is interesting to note in connection with the attempted invasion under Tinmal in 1760, which landed at Carrickfergus, that England was then in possession perhaps of the most absolute command of the sea has ever held. When, as Professor Laughton says: "Hawke and Boscawen had completely crushed the French navy; when our ships cruised unmolested in the Bay of Biscay, or lay peacefully at anchor in the French roadsteads; but for dissensions amongst the French, Belfast would have been sacked."

In the years from 1864 to 1870, while the number of vessels in commission in the Channel and in the North Sea amounted to nearly three hundred, the coasts of England were repeatedly liable and subject to insult. Large numbers of gunboats for harbor defense were also in use by the English, but it was impossible to cover every point, and secure every such point from predatory attacks.

Another set of considerations of recent development, emphasizes the need of permanent coast defenses. The annual naval manœuvres carried on in England and Russia especially, have shown most conclusively that even under peace conditions, the complete blockade of steam vessels is very difficult, if not impossible. Vessels have escaped in the English manœuvres, and have proceeded to raid the enemy's coast, sometimes even in violation of the plainest strategic principles. The blockaders have been compelled to concentrate for home defense. In Russia, the blockaded fleet has escaped the blockading fleet both outward and inward. The conclusion is certain that the conception of the proportion of the numbers of the blockading fleet to those of the blockaded to ensure coast defense, must be largely increased, which opens the possibility, also, that less places can be blockaded. In the Civil War, the ingress and egress of blockade runners was not stopped until the last stronghold of the Confederacy was in the actual possession of the fleet.

In the French naval manœuvres of recent years, it seems to have been an accepted assumption that the possibilities are all in favor of attacks on the coast line. The dispositions for the attack and defense have received the greatest attention. Those responsible for the filling of the two rôles, have been given full powers, and the question—the assumption once made—has received the most careful tactical treatment. The desire is, evidently, to develop the condition as regards efficiency of the coast defenses of all descriptions.

The French manœuvres of 1892 established as far as possible the efficiency of torpedo boats in coast defense. Their success in night attacks upon the attacking squadron was very marked. The superiority of the coast defenses over the fleet was also very generally allowed; but in the Mediterranean, combined operations in the hands of the attacking force were generally successful. A place so open as Cherbourg, where the difficulties in the way of providing suitable coast defenses are extremely great, is considered very efficiently armed against a formal assault by sea. The weakness lies in the rear, where a landing force may be able to possess itself of the heights overlooking the city.*

Serious questions may be raised as to opinions openly expressed in England, that when the command of the sea should have been wrested from the English and when the remnants of her fleets were shut up under fortifications, that it would be the poorest policy for the enemy to attempt direct operations on the coast of whatever nature, such as the bombardment of cities and arsenals, invasion with London as the objective, or a contest with fortifications. It is held that the enemy, by placing himself across the trade routes converging towards the kingdom and shutting the British Islands off from all communications with

* The value of the annual manœuvres is very great in illustrating the need of coast defenses of a certain strength and character for even superior naval powers. In many respects the manœuvres reproduce actual warfare. If vessels escape a blockading force by evasion and without being seen en route, appear before a hostile port or on the enemy's coast and effect a junction with another detachment, they have done exactly what would be done in war, no more and no less. The similitude is real. The question of chance or the point wherein the scheme of the manœuvres is weak, is similar to results which follow the tactical questions when vessels or squadrons come within sight of one another.

the outside world, could soon reduce the invested people to such an extremity that peace would be demanded. The fact that for every four pounds of food stuffs consumed in England for the sustenance of life, not much over one pound is produced in England, gives color and strength to this view. At the same time, it is reasonable to think there is danger of too much being imagined,—it being one thing to assume the possibility of such a complete blockade as is indispensable to reduce England to such a strait, and another thing to carry it out. The customary trade routes may readily be watched; the whole system of supplies may be disjointed; but under such stress other routes will be found. The whole circumference of the Islands must be patrolled, and experience goes to show that patrol and watching are not sufficient. This patrol must be kept up, it should be remembered, under conditions in comparison with which other blockades were child's play. The winter blockade of our Southern ports was terribly hard and difficult, but easy when compared with the winter blockade in the North Sea or in the Channel.

There are cruisers with a maximum speed on paper equal or perhaps a little superior to that of the Atlantic liners, their number in comparison, however, being extremely limited; but their speed is only good for a short time. The cargoes which a small number of the biggest and speediest of the liners could carry into the kingdom—and they will not be constrained like sailing vessels to follow particular routes—would tend effectually to prolong the resisting powers of the nation. It cannot be admitted that a vessel which can average 19 or 20 knots, or even 23 knots and more as they now do, across the Atlantic can be intercepted by cruisers which can make 22 or 23 knots for a limited time under favorable circumstances, while subject to the greatest tension. Of course all the trade under sail or in tramp steamers would disappear. In a vital struggle however, as long as Englishmen can be supplied, it is not safe to look to their giving in under hardships falling short of the unsupportable. An English writer has pointed out that in such circumstances the productive power of the Islands themselves would be doubled or trebled.*

* Not long since the opinion was expressed by Admiral Long, R. N., that there is no power on earth that could prevent food stuffs and raw material entering the country.

At such a stage of the war, the manufacturing interests would be employed to their utmost; workmen would suffer, but shipbuilding would go on in all its forms. Fleets would be repaired and provisioned, torpedo boats built, concentration effected, but all under fortifications, without which the downfall of the Empire would indeed be coincident with the loss of the command of the sea. Fleets or their remnants would begin to make their appearance from India, from the Pacific, from every direction. Communications would be managed in some manner if entrance could not be secured, and the ordinary strategic combinations would be arranged.

With the exception of the naval school to which reference has been made, thinking Englishmen are satisfied that the approximate sealing up of the enemy's fleets to the extent of preserving the coast line from all insult, while desirable, is a dangerous myth. The enemy's fleets must be met in battle, and the English, as well as the enemy, must endeavor to be superior at the point of contact; while providing otherwise and contingently for the actual safety of the coast,—but it is unnecessary to form such opinions concerning England's policy, for it will hinge assuredly in the end upon her so far unrivalled sea power.

To a power such as the United States, up to now contemplating naval inferiority, and having in view a small navy comprising many types, the words above quoted of Captain Mahan are full of meaning,—and it is only the possession of a greatly superior naval force that can in any degree justify the neglect properly to fortify the coast, and to maintain the organization necessary for national defense. Of all the sea powers England

In former days the English have blockaded, or masked, all the military ports of France and Spain combined, at the same time maintaining squadrons in other waters. It is difficult to believe that it will ever be possible for them to do so in the future, and this is practically admitted.

The French fleet was able twice to elude Nelson off Toulon, but in those days some judgment could be formed as to the direction taken by the escaping fleet by the direction of the wind, and it could be pursued with better chances of being on the right track than now. It was Collingwood's opinion, that the fleet in Toulon could always escape when it wanted to. The observer on the hill could watch the masking fleet, and give the proper directions to the inside fleet, enabling it to elude the watchers. This may perhaps be taken as an indication of a sphere of usefulness for balloons in coast defense.

alone,—and then only while supreme at sea,—can in any way treat the question of harbor defense lightly,—but if she should do so, with her wealth, she would be taking unnecessary risks. But as before stated, England has placed her coast line in a remarkably efficient state of defense, some of the engineers going to the extent of criticizing the magnitude of the works, claiming unnecessary strength at some points.

The frequent and favorite conception of the rôle of fortifications in coast defense, viz., to set the navy free to take the offensive on the enemy's coast line, while the home coast will be protected by fortifications, appears to be somewhat faulty.

It is not clearly apparent that the actions of a navy in war would be greatly affected by the presence or absence of permanent defenses, provided that the general balance as between the superior and inferior force was not disturbed nor altered. The navy in defending a coast has its own peculiar ways in doing so. It is true that the total absence of fortifications would place a great weight of responsibility upon a naval commander, but, it may be asked, how would the presence of fortifications affect the diverse strategies of a superior and an inferior fleet. Would their presence, for instance, permit the inferior fleet to cross the ocean to assume the offensive on our enemy's coast, while that enemy's fleet was either in observation of the inferior or contemplating enterprises on his coasts?

The relations are much closer than those suggested, and the action of the navy should be no less defensive in its results than that of the permanent defenses. So far as it lies in the power of the navy, a great part of its whole duty is to relieve the strain on the coast line in whatever manner that can best be accomplished.*

If, by threatening one or more important strategic points the enemy is drawn away, the navy has fulfilled its mission in that respect. Serious operations of any nature of an inferior navy against an enemy's coast are accompanied with the greatest risks, and in these days of steam and ready communication,

*Throughout all the wars of the 18th and 19th centuries in which England has been engaged, it has been insisted by admirals and statesmen that the attitude of the English navy has been entirely defensive, and yet the scene of the action has been largely away from the British coast.

they are still more hazardous than formerly. Such an operation in the old days could take place and be effective before the intelligence that it was contemplated could be received, and the length of time required to act upon the intelligence was vastly greater. To-day the lookout and the cable would give the news instantly. Calculations regarding time have to be made with the greatest nicety, and any operation requiring a length of time for its accomplishment, with the attendant contingencies, should be considered extremely rash, though perhaps justified.

The permanent defenses, besides exercising this deterrent effect, further gain time in which relief may come, be it to repel an invasion, or to raise the maritime siege. This growing importance of the element of time with other considerations brought about by steam and quick communication may have produced a modification in some of the strategic combinations in a maritime war, but what they may be, until subjected to test, no one can say with authority. Blockade is forbidden to the inferior navy, and there can hardly be two opinions now-a-days as to the non-efficacy of commerce destroying as a main object in maritime war.

The inferior fleet engaging a detachment of an enemy's fleet is as surely taking part in the defense of the coast as can the permanent defenses. If unsuccessful, the victor may be so disorganized as to force him to abandon any attempt, and thus time is gained to the defense.

At the battle of Yalu the superior force, the Japanese fleet, was so disorganized by victory that the advantage was not pushed home. The Chinese vessels not captured or destroyed were thus able to make Port Arthur in safety where their presence contributed to prolong the defense.

Coast-line battleships, a term accorded to some of our battleships, while it is perhaps a little offensive to those who object to the restriction of vessels to coasts and harbors, is none the less, an accurate definition of every battleship in the world.

There is one position in which ships are of no use in coast defense or anything else, and that is where a number of them are shut up in a port under no matter how many guns, if no outside relief is looked for. Such a fate might easily befall the vessels of an inferior fleet seeking repairs or stores in the best protected arsenal, where there is little or no possibility of the blockade

being raised from the sea. Cervera's predicament in Santiago may be recalled. It may appear that the positive assurances we sometimes hear as to the rôle of fortifications on the seacoast need some little modifications. They can without doubt put certain places or positions beyond the power of actual physical injury from the side of the sea, but they can hardly set vessels free from the same duty. At a point such as Key West, for instance, they are absolutely dependent upon a navy for their existence, in other words, for their defense. They have done their work when in addition to protecting an important base for the navy they have gained time, and their whole rôle is bound up with that of a navy.

It is possible that in the minds of some people other misconceptions have arisen as regards the functions of a navy in a maritime war. Can it be supposed, for instance, that our navy could carry the operations of war to an enemy's coast while our own shores were threatened? That each navy, our own and the enemy's, would be free to act offensively against the coast of the other? Such a state of affairs cannot be imagined. Navies cannot be set free in any such sense by fixed defenses. The first objective of any navy is the enemy's fleet,—to fight it if able; to keep touch with it always, and to endeavor to create the opportunity to attack it on favorable terms whether it be on its own or on the hostile coast, and it is almost beyond question that the main operations will be in the waters of the inferior power.

In an official communication made to the Chief of Engineers in 1881 by Lieutenant-Colonel Q. A. Gillmore on the general subject of seacoast defenses, after recapitulating the weakness of our seacoast fortifications, in view of recent strides in the production of destructive engines of war, born of modern invention and science, the question is reviewed as to the entrusting of the defenses of the nation to one of the elements of defense singly. He discusses the question most ably, and conclusively establishes that such a policy would be ruinous. Concerning naval defense, he says:—"The idea that a navy, especially an 'ironclad navy,' can furnish a sure defense, although both attractive and popular, finds no practical application among naval powers. Its soundness as a theory is freely admitted

because a harbor fleet, if as powerful as the enemy's, would be expected to make and no doubt would make, a good defense. Every one at all familiar with the achievements of our navy will cheerfully concede that point. But, at the very best, in that case our chances of victory would be only equal to those of the enemy, while the risk taken and the consequences to ensue from failure would be greatly unequal; for while the enemy could lose nothing but his fleet, we would lose not only our fleet, but those much more valuable possessions which the fleet was designed to protect. Where interests of great magnitude are at stake, ordinary prudence requires that as little as possible should be left to the caprices of chance. A safe and perfect defense of this kind implies, therefore, a harbor fleet somewhat more powerful than that of the enemy.

"It implies, also, that each point deemed worthy of protection, large and small alike, shall have a fleet as powerful as that required for the most important localities. Otherwise, lacking strength at all points except a few, our smaller navies, and the objects to whose defense they had been assigned, would be destroyed in detail. And finally, after having accomplished this work at his own time and pleasure, the enemy might, when confronted by an equal or superior force at our strongest positions, decline battle altogether, withdraw from our coast, and direct his efforts against our commerce upon the high seas, a commerce left entirely at his mercy by the policy which keeps the navy in port for home defense. The enemy having left his own ports well defended by fortifications, a condition substantially true of all great maritime powers except the United States, would be free to adopt this course.

"If it be contended that a proper naval defense can be made by seeking the enemy upon the ocean, or by shutting him up in his own ports, thus leaving our coast entirely defenseless—without either forts or vessels of war—the answer is that such an assumption is not only at variance with all the lessons of history, but is in itself intrinsically illogical and weak. The power to escape from or to evade an enemy upon the high seas or break through a blockade, never very difficult of achievement, especially at night, even in the old-time sailing vessels, has been rendered comparatively easy and certain by the introduction of steam.

"Moreover, under this method of defense, the weight of advantages would be with the enemy, and the weight of risks with us. Being equipped and embarked for a naval attack on our coast he could scarcely wish to encounter our fleet, constituting the only defense of that coast, under circumstances of brighter promise to himself than those offering upon the broad ocean, for he could then either engage us in battles, or withdraw, under cover of night; and should he elect to withdraw, which would be the prudent course if inferior to us in strength, he could, at his option or as might suit his purpose best, either retire under his own fortified ports, or pursue and destroy our commerce on the high seas, or make a sudden descent upon our unprotected coast. Should he adopt the last named course, he could even venture for this purpose to subdivide his fleet into small detachments, being certain of success at all points, because certain of finding our harbors unprotected by fortifications, and our fleets absent upon the broad sea. It would seem therefore that a cruising force, even if much more powerful than the enemy's, cannot be wisely relied upon for the defense of an extended seaboard.

"These views are neither new nor novel. They are, moreover, believed to represent the matured judgment of the highest military and naval authorities, as they unquestionably do the practice of the great maritime powers of Europe, as embodied in their methods of seacoast defense. If they be substantially correct, as stated, a secure defense by naval means, although entirely practicable, requires not only that the navy shall be permanently retained upon our coast, and within our harbors, but that its power at each point deemed worthy of protection shall somewhat exceed that of the single fleet which the enemy can bring against us. Not knowing where the enemy intends to strike, it would be necessary to be prepared for him at all points. If twelve armored vessels, properly equipped with torpedoes, be assumed as the limit of the offensive power, we must maintain more than a score of fleets, each more powerful than the enemy's twelve vessels, in order even to defend a few of our most valuable localities, and prevent their destruction and capture. And even upon this broad and costly basis, nearly one half of our harbors for armored vessels and more than one half of our Atlantic and Gulf coasts would be left entirely defenseless."

This extract is given in full for a twofold purpose and because it is the opinion of one of the highest authorities. In the first part of the extract, the author deals with the question of naval defense, apparently limiting the sphere of action to defensive vessels located within harbors without power of concentration, in other words, to coast defense vessels in the most restricted sense. His arguments have been used a great many years and with good effect. They should absolutely and forever put to an end any idea that a navy, however powerful, divided up among the harbors of a country, unless always and everywhere presenting a front of greater strength than any possible force to be brought against it, can be considered as anything but a navy destroyed. Unless, indeed, the detachments are composed of seagoing fighting vessels, to which the opportunity for concentration may occur before the detachments of the enemy's fleet can combine in superior force,—such as the opportunities offered occasionally to the Spanish and French in the great naval wars of the last century and the beginning of this,—but how would it be with vessels fit only to fight in smooth water? President Jefferson upheld a scheme of the kind for a while, but it was ultimately put aside, and Major-General E. P. Gaines in 1839 strongly urged such a scheme upon the attention of Congress, happily without success.

It may be that there are people to-day who pin their faith upon thus continuing the naval policy of the country, but a contemplation of the question from the point of view as stated, should be sufficient to satisfy them of their error. No possible issue can be taken with General Gillmore upon the question as to the need for permanent defenses and the danger to the coast without them, but in balancing the risks and benefits to the attacking and defending force he says that a victory for the defense would cause only a loss to the attack of its fleet, and he does not refer to the incidental preservation of the coast line insured by that destruction of which history is so full of examples, even when there has been no destruction to speak of. In the remainder of the extract the author deals with the question on the assumption that the vessels may even form a cruising force, and it is submitted that what has been said as to misconceptions on the part of some people concerning the functions of a naval force in naval defense needs no further demonstration. A fleet is

equipped abroad for a naval attack upon our coast, and of course we are presumably in perfect ignorance of this. It is admitted that he may be inferior in strength. Our fleets are absent upon the broad sea somewhere, certainly not watching the enemy's fleet; the enemy being superior or inferior in power but equipped for a coast attack seeks the accomplishment of his object through evasion, which should be very difficult if thorough alertness and preparedness are displayed by the Admirals of our fleets and the intelligence staffs. He even divides his superior or inferior force into small detachments and falls upon our coast line at all points, or, as it might be put, he divides his forces in the presence or the existence upon the sea of a superior force. No exception can be taken to the statement as regards the practice of the great maritime powers of Europe, as embodied in their methods of seacoast defense. The practice so far as is known lies in a proper coordination of all the elements of defense, together with a frank recognition of the preeminent and preponderating place of the naval defense. The hypothetical demonstration of the requirements necessary in order to ensure a perfect naval defense in the last paragraph does not concern those who concede the indispensable nature of permanent defenses.

But the numbers used go far towards the conviction that twelve ironclads of the enemy would be lost under a better conception of what is meant by naval defense. It seems it would require more than 240 similar vessels opposed to the twelve under the system of defense which he declares to be entirely practicable, and then, " more than one-half our entire Atlantic and Gulf Coasts would be left entirely defenseless."

After disposing of the general subject-matter as regards seacoast defenses in the ablest manner, the author answers the questions as to what are the exclusive and appropriate duties of the navy, as derived from high naval authority—" as aggressive war is the special mission of that arm (the Navy) . . . the country would expect it to protect our commerce on the high seas and convoy it safely into port, enforce respect for our flag in foreign ports, capture the enemy's merchantmen, and destroy or confiscate his goods contraband of war; search out and engage his armed fleets; blockade his ports; and generally, as Admiral Dupont once said ' carry the sword of state upon the broad

ocean' and 'contend for the mastery of the seas where alone it could be obtained, on the sea itself.'" Not one word here about attacking the enemy's seacoast fortifications. We are to spend millions as against his coast attack and no provision for us to get any return for it. One policy for us, another for the enemy as he is always to be freed by his fortifications behind him. It will be noticed that the seeking out and engaging the four armed fleets and of blockade are placed last in the list of naval duties, and it is not made clear where the attack on our coast is to come from if the enemy's armed fleets are sought out and engaged unless our fleets are destroyed, and then what can fortifications do?

It is but proper to say that the letter closes stating that it is not "specially addressed to the technical expert in military or naval affairs," the wish being "to reach that larger class of intelligent thinkers who mold the ideas and dictate the laws of the nation." History, his own experiences, and our reasons, agree with all that General Gillmore has to say concerning the efficacy of a navy tied in detachments. He has as large an opportunity during the war as any individual to see the total inefficacy of such a system and into the use of which the Confederates were driven, but there were many who failed to see how the Union fleets were protecting the northern coast winter and summer while before the southern ports, and to which fleets the sea coast fortifications of the north were not, as it happened, of much use.

Where General Gillmore refers to the ease with which a blockade can be evaded in these days of steam, and the fact that the assumption of a close blockade is at variance with the teachings of history, he is of course undeniably correct, but it does not seem that he pursues his argument to a logical conclusion, or rather that his succeeding assumptions are only assumptions not based entirely upon history. The assertion is made that "being equipped and embarked for a territorial attack he, (the blockaded enemy,) could scarcely wish to encounter our fleet." It might be asked what was the object of all the grand fleet movements of the French and Spanish in the Napoleonic wars if not to neutralize the action of the English fleets? The command of the English Channel was deemed by Napoleon absolutely essential as a preliminary to any territorial attempt upon

the shores of Great Britain. The superiority of his fleet was the object of his manœuvres. The detachments of the allied fleets were not shut up in the ports, but they were tempted in every way to come out, and when they got out their only object was to gain, by combinations, a superiority over the enemy. This they were unable to do simply because of the proper strategic use of the English fleets. They knew too well the absolute futility of merely avoiding these fleets.

The idea that such operations of hostile fleets, as each acting independently on the enemy's coast or preying upon his commerce, had any influence in bringing war to a close was definitely abandoned in the 16th century. The question is sometimes put thus; if the fleets are equal and succeed in inflicting equal damage, how then is the war advanced to its close any more than if no damage were inflicted? It is inevitable that the first struggle will be for the command of the sea, in case such command is not admitted in the beginning. Imagine ourselves at war, possessing a great naval superiority, and with our harbors unfortified; the harbor of the enemy being provided with efficient works,—can any one suppose that the inferior fleet would have any time or inclination for attacks upon our own coasts, which could have no appreciable effect on the ultimate result except in the exasperation of the people? On the other hand assume our coasts fortified, and our fleet the inferior. If any one has shown or if any experience has demonstrated how the fortifications, so long as our inferiority at all points exists, can free our fleet to attack the enemy's coasts so as to make any impression upon him, it is not generally known. The fate of a coast rests in the beginning and in the end, fortified or not fortified, *upon the command of the sea.* This does not mean that the coast should not be fortified, but seeks to determine what strain may be brought upon the line of fixed defenses and at what stages in a naval war.

If commerce can be protected, and the coasts secured from insult by naval actions,—it is then certain that the navy is the factor of first importance in defense, but the other factors cannot be disregarded. A very complete instance of the relations existing between fleets and fixed defenses is to be found in the events connected with Nelson's great victory of the Nile. The departure of the French fleet with Napoleon's expedition to

Egypt freed Nelson, and when that fleet anchored in the unprotected waters of Aboukir Bay it had accomplished nothing and had given Nelson the opportunity he desired. So it may be said that when the fortifications of Toulon freed the fleet from the duties of defending that harbor by an active offensive against Nelson, that they did a very bad thing for the fleet and for France.

It is easily apparent that the naval policy of England should be just what is laid down by Captain Mahan, and it is asking too much that the whole fabric of defense should rest upon that one line of vessels on the enemy's coast. If it should happen, for the sake of argument, that at last the fate of the British Empire hung in the balance to be decided by one grand fleet action on the enemy's coast or elsewhere, it is certain that were the English fleet successful, fortifications would play no part. If unsuccessful, they would be of no use. But before the Empire could be reduced to such a strait, fortifications would have played their useful part in covering and sheltering vessels of the fleets seeking repairs, in forming safe harbors for a belated commerce, in deterring light squadrons from raiding the coasts, securing, starting and returning points for the mobile defenses,—and above all in case of disaster to the fleet, sheltering it and gaining time for the certain relief to be expected from other fleets.

Previous to the battle of Waterloo, while Napoleon was projecting his march upon the allies in Belgium, he divided the army into corps, and assigned to Marshal Grouchy the command of the right, and to Ney that of the left, entrusting the defense of Paris to Marshal Davout, himself commanding in person the reserve. Davout pleaded with him for the command of the right in place of Grouchy, who had never commanded more than a division, urging that in face of a decisive campaign such as the one projected, that interior defense was wholly secondary. He said, " If you are victorious, Paris will be yours; if you are beaten, neither I nor any one else can help you." Whatever the fact as to the mooted question that Napoleon's refusal to comply with his urgings may have contributed to the loss of the battle of Waterloo, these words express completely the limits placed upon fortifications in such contingency. Had there been in the field another army, or had it been possible to

create another army in France, with Paris as the rallying point, the fortifications of Paris would have been of immense importance. The fortifications of Plevna would have played just such a part had there been another Turkish army in the field. In another war, in 1870, the defenses of Paris fulfilled to the utmost the province of fortifications, but as the military resources of France were exhausted, it may be questioned if she might not have fared better if there had been no fortifications. On the sea frontier, her coast defenses from the nature of things were of no use whatever to her, except that they prevented depredations which do not seem to have been very seriously contemplated by the weak German navy. But the seacoast fortifications of Germany were of great utility to her in conjunction with the small German squadron stationed in the Jahde.

The naval events of the Franco-Prussian war are again referred to, for while very little was accomplished on either side they are extremely interesting and throw very strong side lights upon the mutual relations of the elements of coast defenses. Indeed some authorities go so far as to deduce from them a corollary to the laws of naval strategy, to the effect that a superior naval force will not proceed to territorial attack while an inferior force is in existence free to act, though at a distance so great as 800 or 900 miles. We can assume this to be almost absolutely true, and the incidents of this war upon which it is founded or its truth corroborated, are worthy of notice, but it is not thought they bear out the assumption so fully as do many historical events. While great strides have been made in the development and refinement of weapons and in the organization of the *personnel* of fleets and coast works since the date of this war, yet, the strides that had been made up to that time were great, and the resemblances between the fleets of that day and those of to-day are so close that we may rationally expect to see a repetition of many of the circumstances surrounding the actions of the French fleets, and certainly there is a great deal to be learned from the defects and limitations which were brought to light.

At the outbreak of the war, it was designed that Germany should be assailed in front on the road to Berlin, and at the same time that a combined army of French and Danes, supported by an ironclad fleet, should threaten the country by the northern

flank. At that time, the French navy was to the German navy as three to one,—and there was ample ground for the belief that the Danes would furnish a quota of 40,000 troops, which with the 30,000 to be sent from France by sea under General Bourbaki, and the covering fleet, would certainly immobilize at least 200,000 Germans for the defense of their flank. As a matter of fact, the mere threat of such a formidable attack was sufficient to cause the German leaders to post an army corps of five divisions, in addition to all the troops belonging to the four divisions of the coast, on the neck of the Jutland peninsula whence it could succor the shores of the Baltic or the North Sea as occasion demanded,—and for a long time the main army of the Germans was deprived of this great number of men. Count Bouet-Willaumez was selected to command the mobile squadron to be sent on ahead, and upon him in the end largely fell the blame for the lack of results which seem to have been mostly due to the want of understanding in Paris of what a fleet could and could not do. In the first place he was started off with a fleet consisting of seven ironclads and one corvette insufficiently coaled and supplied, instead of at the head of a fleet promised him of fourteen ironclads, corvettes for lookout work, and especial vessels, so necessary for territorial attempts, and complete in every respect. There was also a lack of desirable charts in his fleet. This was to be followed by a second fleet, so constituted as to make up all deficiencies and to convoy the army corps of Bourbaki. It also happened that his fleet could not be efficiently manned because the outbreak of the war found the men of the inscription maritime, who should have been immediately available, away at the fisheries.

The instructions to Bouet-Willaumez were to cruise off the Jahde and to bring the German vessels there to action; he was forbidden to attack open coast towns. He found himself unable to force the Germans to fight, and put into a Danish port for coal.

The French minister ordered him to the Baltic, then despatches came for him to detach a force to observe the enemy in the Jahde and to establish a base somewhere to watch the German coasts and also to observe Danish neutrality, all of which was a large undertaking for a fleet three times the size.

Finally, a definite order was received to proceed to the Baltic, which he did with the aid of Danish pilots, and after establishing his base in Kioge Bay, a few miles south of Copenhagen, he proceeded to reconnoitre the German coast in order to familiarize himself with the condition of the defenses and the possibility of throwing the coming army on shore. He also desired, if it should be found feasible, to attack some of the fortified coast towns; though for the lack of special vessels, he had little heart for the work, and the harbors all appeared efficiently obstructed. Stakes, submarine mines, nets, and vessels ready to be sunk, lay at every entrance; and the nature of the coast where all lights were extinguished and buoys removed, made approach very hazardous for a heavy squadron. In this situation, the Admiral one day in August received three contradictory orders by telegraph; one ordering him to return to France, another countermanding the first, and a third to strain every nerve to do the enemy injury as the French army had suffered reverses. By this time the Admiral had selected a place which was to be utilized for the great landing and which was suitable for the base of operations which were to commence on the Schleswig coast.

The order also informed him of the departure from Cherbourg of the second squadron under Admiral Fournichon for the Jahde, but nothing was said about landing forces, and he was further told that his chief means of action lay in close blockade of the German commercial ports.

He again reconnoitred the coasts and returning to Kioge Bay summoned a council to submit a written report upon what was possible to be done with his squadron.

The report of the council is interesting in many ways, and especially in calling attention to the limitations placed upon a homogeneous battle fleet in the presence of coast defenses:—

"Alsen.—The depth of water will not permit an approach to this point within at most 3000 m., a distance at which engagement would be useless on account of the plunging fire of the forts. Nothing is here possible without a force to land. Besides it is most probable that submarine defenses extend along the shore, which it would be indispensable to remove, and which would not be attempted until the squadron was supplied with necessary materials.

"Duppel and Kappeln.—Completely out of reach from the

ships' guns. Too little water in the bays. We could only get at them with armored gunboats.

"Eckenfjord.—It is easy to destroy the isolated batteries, but they are of no importance, and without the possibility of throwing troops on shore the reduction of the forts would be insignificant.

"Kiel.—It would be necessary to employ the whole force of the squadron, the success of gun fire uncertain, on account of the height of forts above the shores, and the losses certain for the assailants if they were not able to occupy the forts as they were silenced. The forts at Fredericksdort being destroyed and the squadron unable to penetrate to the bottom of the bay within gunshot range of Kiel, on account of the obstructions, the torpedoes, and all the means which have there been accumulated, the French ships would be forced to retire without even knowing the result of their attack.

"Neustadt.—An open town and without defenses, but with a bay so shallow that the French ships could not even reach with their projectiles the merchant ships which are anchored some distance from the port, properly so called. It is the same all along the coast so far as Colberg, a strong place besieged in 1807 and attackable from the sea at 2200 metres. Before entering upon action there it will be necessary to make a reconnaissance in order to make certain, that the houses along the shore, the casino in particular, do not mask fortifications which would compel a modification of the form of attack.

"Danzig.—The fort at the entrance of the bay is within range of our upper deck guns but only at a distance of 4000 metres. The battery guns could not be used elsewhere with advantage.

"Conclusion.—Colberg and Danzig alone can be attacked; but the small effect which will result from these two attempts will be of a nature to deprive the French squadron of the prestige of its force. In order to operate usefully, special vessels are required and the prospect of forcing the enemy to assemble his troops on this part of the littoral, but this end is unattainable without a landing force."

This report is valuable as showing the condition which confronted the naval Commander-in-Chief, and what under such circumstances may be considered as the indispensable requisite for a fleet in order that it can enter upon a course of warfare

other than engagements in the open sea. Bouet-Willaumez had taken his squadron, through the only channel available, without charts and with but nineteen inches at times under his flagship, only to find himself in a condition to be able to do almost nothing. Blockade did not amount to much, for the Germans were keeping their vessels, which had not been turned into Swedes or Russians, in port, and small vessels continued with impunity to pass along the coast, while small gun- and torpedo-boats continually harassed the vessels of the French squadron. One light draft monitor showed what such vessels could do on certain coasts in the way of eluding hostile vessels and keeping out of reach of the only vessels that can harm them, but as the monitor accomplished nothing except to keep out of range, the lesson is not enforced. If Bouet-Willaumez had had a few torpedo cruisers he might have destroyed the monitor which was hardly, under the circumstances, a threat to him.

At the moment of receiving this report the French commander, who had determined to make a demonstration against Colberg, received news to the effect that the German fleet had left the Jahde and had been seen heading for the Baltic. He did not hesitate for a moment, but headed for the enemy. The information was wrong, however, for the German fleet was now closely blockaded by another detachment of the French fleet, and Bouet-Willaumez learning of this, declared a paper blockade. He divided his squadron to blockade two sections of the Baltic coast 300 miles in length, and left two vessels in the open sea. Gunboats made their appearance at all times, and proved very harassing, for there was but the one vessel to act against them. In replenishing at the base, each vessel required another as a guard, and the squadron was being exhausted while actually doing nothing. A few changes took place in his fleet, two of the heaviest vessels being replaced by lighter vessels, one being the Rochambeau, the old Dunderburg which du Pont Jest says France swept away from Germany for a consideration of some millions when she was put up for sale in New York. The French Admiral determined again to operate against Colberg with a detachment of his squadron. Arriving off the place, he saw the terrace of the Casino crowded with women and children and the Geneva cross flying on all the principal buildings of the town. After consultation, he determined not to

make the attack, and drew off. A few days later he received a despatch coming from the French ministry which the author before quoted claims was probably a ruse de guerre, ordering him to bombard the open towns of the Prussian coast. The Admiral disregarded the despatch, and was now engaged in fighting the September gales. At his base he heard of Sedan and received orders to continue the blockade and to injure the enemy. He again determined to bombard Colberg, for now the place was largely deserted. The bad weather, however, defeated his object and compelled his return to Kioge Bay, where he received word, this time accurate, that the blockade of the Jahde had been raised, and he then determined to proceed in that direction. He arrived off the Jahde and cruised a day, but the German vessels would not come out; he then returned to Cherbourg, and thenceforward two squadrons alternated in watching the North Sea coast of Germany,—and to make things doubly sure, some vessels cruised in front of the French ports to blockade any German vessels from getting in that might have escaped the watch on the German coast.

In view of the circumstances as just given, which are substantially accurate, it is not quite fair to say that the little German squadron in the Jahde prevented any attempts against the coast cities in the Baltic. It certainly had its influence, but so did the bad constitution of the French squadron, the character of navigation, the bad weather, and the formidable character of the coast, beside the dislike of Bouet-Willaumez to bombard towns which would have given the Germans such good grounds for reprisals in kind. All these events are significant enough without an effort to emphasize the influence of a naval flanking force which has always been in evidence. Besides, if he had been fully bent upon coast attacks, all he had to do was to make them while keeping a lookout to the northward and he certainly could have counted upon receiving accurate information quickly through the Danes of the proximity of the German fleet. But it is perfectly true that no serious attempt requiring a period of time in its execution, could have been successfully undertaken while there was the certainty, or even possibility, of interruption. On the western side of Denmark things were also going in a similar manner to those in the Baltic. Admiral Fournichon, in command there, could not establish any base, owing partly to the

nature of the coast and to the constitution of his squadron which was similar to that of Willaumez though he had four small vessels. All his replenishments had to be made in the open sea, yet for a time he managed a complete blockade of the Weser and of the Elbe, but quoting du Pont Jest once more "soon unfortunately, the weather became bad, gales succeeded gales, and the replenishment of the ironclads which could only be done by boats in the open sea, became very difficult. The heavy ships of the fleet continued to struggle vigorously against the elements, but the colliers and store ships not only failed to arrive with the same regularity, but they often remained knocking about at sea before being able to join the squadron, and the loss of a certain number of them was fatal. Moreover, the season was advancing, the equinoctial hurricanes were imminent, and the French ironclads would soon find themselves without coal in the most critical position."

Fournichon, nevertheless, maintained himself in position for sometime, but was about to give it up when he received news of the downfall of Napoleon and his own appointment as Minister of Marine. He then left the station with his squadron and hastened to Paris thus raising the blockade, upon which Bouet-Willaumez proceeded off the Jahde. In all these operations, the open coast towns owed their safety largely to sentiment. As fortified places, the influence of fortifications in preserving them is sufficiently apparent, as well as the influence of the German fleet. There seems no necessity to go to the extreme of claiming that the German fleet saved the coast.

In our Civil War the fortifications of the North did not come into play, while those of the South were of the last importance to the cause. They enabled her to hold out to an extent possible only on condition of their existence. The margin by which the fortifications of the North escaped the test of trial was very small indeed. Had the plans of the Confederates for the acquisitions of vessels abroad have proved not generally abortive, several ironclads, powerful for that day, might have made their appearance on the coast, in which case fortifications would have filled an important rôle. In concluding his volume on France and the Confederate navy, Bigelow says, "Had Amman's ships been ready for sea a year sooner, as by his contract they should

have been, when Mr. Lincoln's cabinet was rent by dissension, and a presidential election was impending, it is not probable that any amount of remonstrance on the part of our diplomatic agents would have prevented their being allowed to embark upon the predatory career for which they were designed. They would not only have opened every Confederate port to the commerce of the world, but they might have laid every important city on our sea board under contribution, the most probable result of which would have been a humiliating peace . . . Had the war continued but a month longer, the Stonewall would have been in possession of Port Royal, and if two months longer, the City of New York would probably have lain at her mercy. One more defeat or one less victory of the Union arms would certainly have given the Confederates one, and probably four vessels, each more formidable than anything that floated the Union Jack."

So far as Confederate activity in England was concerned, vessels of various types were built or contracted for with the avowed purpose of operating on the Northern coast, in addition to blockade runners and those built for operations against commerce. Three of these vessels were especially designated for a raiding expedition against Portsmouth, N. H. Two of the vessels, monitors, were in existence not long ago on the British navy list as the Wyvern and Scorpion. Had any of these vessels appeared on the coast, there seems no reason to assume that they would not have met with the ultimate fate that belongs to the greatly inferior force, and before they could have inflicted much damage. Mr. Bigelow's distressing picture seems overdrawn but there can be no doubt that the danger to the coast-wise cities was real and great. Captain Mahan's words before quoted seem to cut the knot of the difficulty concerning seacoast defenses in assigning the definite place of each element of the defensive system. For an inferior naval power, the policy is clearly indicated also by Captain Mahan: "On the other hand that Napoleon when convinced that he could expect nothing decisive from his fleet accepted the use of it as a means of harassment or of diversion, must be received as a weighty indication of the naval policy suited to the inferior naval power. To assume a menacing attitude at many points, to give effect to the menace by frequent and vigorous sorties, to provoke thus, a dispersion

of the enemy's superior force, that he may be led to expose detachments to attack by greater numbers, such must be the outline of conduct laid down for the weaker navy. But that such a course may be really effective, that the inferior may as in some of Bonaparte's wonderful campaigns, become ultimately superior, there must be at some fitly chosen point of the sea frontier a concentrated body of ships, whose escape if effected, may be the means of inflicting a great disaster upon the enemy by crushing one or more of the exposed fractions of his fleet. Unless there be such a central mass, mere dissemination is purposeless. Inferiority carried beyond a certain degree becomes impotence."

Fortifications are as necessary to the development of such a policy as the fleet itself, the inferior fleet if not sheltered behind fortifications in crises which will arise, may be attacked by a superior force and its efficiency destroyed. The French fleets of the revolution and later lay safely under the guns of their fortifications waiting the opportunity for sortie,—the long and weary watching of the French and Spanish arsenals by the British soon would have been cut short in many cases but for the fortifications, which also played an important part in the preparations of the Boulogne Armada, the boats and transports for which had to be assembled from as far east as the Scheldt to Brest in the west. The coast defense on this line consisted of permanent batteries on all the headlands, with field batteries stationed at intervals able to follow the transports and cover them. The character of the coast enabled these vessels on account of their shallow draft to creep along the shore out of range of the guns of the British cruisers, while the cruisers themselves, were under the fire as it happened, of the superior coast guns. The operation of concentration was of course greatly hampered, extending as it did, over such a long period, but it was not materially affected. The attack from the sea at that time was deemed hopeless on account of the completeness of the defense, at Boulogne alone 500 guns being mounted. Unsuccessful attempts were made at bombardment, and cutting out expeditions were vainly attempted, and in recording the failure of such a cutting out expedition in front of Boulogne in 1801 in which many lives were lost, Lord Nelson wrote that, "all behaved well, and it was their misfortune to be sent on a

service which the precautions of the enemy rendered impossible to succeed in." Lord Nelson was generally disposed to discountenance attacks upon fortified positions, and all the time he was in front of Toulon the three batteries which covered the outer roads were quite insignificant, but the case was just one where he cared nothing for the fortifications except to leave them alone, it was the fleet that they effectually sheltered that was his objective. The Mediterranean coast from Marseilles to Genoa, was provided by Napoleon with defenses so placed and of such a character that his supply vessels could pass along in safety in sight of the watching frigates. Mobile batteries were also a feature of these defenses.

At two different periods in the early part of the 18th century Vigo fell under a combined attack by land and sea. On the second occasion, the formidable character of a citadel enabled the defenders to hold out for eight days before capitulating. The citadel of course, stood for so many more men of the garrison which could not have held out in the open. Admiral Colomb remarks upon this and his words tend to give a still clearer conception of the place fortifications should hold in defensive schemes: "The reflection occurs that the delay was useless, and only caused additional loss to the Spaniards; but that it might have been of supreme importance had a relieving force been in position to arrive before the eight days had expired. As the matter stood, it is impossible to say that Spain was in the smallest degree advantaged by her fortifications of Vigo, though if the strength of the fortifications of Corunna had to do with the changing the objective to Vigo, we have their value exhibited there." *

"The difficult strategical and economical question appears to hinge on relative cost. Was Spain at that time spending on her fixed coast defenses and their garrisons a sum which would have provided a fleet which must be watched before any territorial attacks could be considered by her enemy? If there had been five or six sail of the line at Corunna, Admiral Mighells must have kept his whole force there to watch them, and the accidents of blockade would have made it necessary to have a like fleet

* On the occasion of the last siege of Vigo the attacking squadron had been previously before Corunna and had abstained from an attack.

with Lord Cobham's transports. If it had been necessary
double the naval force employed on the expedition, would it ha
been contemplated at all? History seems to bring these que
tions before us as of everlasting practical importance." Tl
English extremists would probably not be willing to str
Portsmouth, or the Thames, or other points, of their guns
the question were put squarely to them.

The fraction of the inferior fleet taking the sea for the purpo
of creating the menace runs the chance of its speedy destructi
unless it disperses, each unit bent on doing all the destructi
it can in its perhaps short-lived career. According as its wo
of threatening or of destruction is better achieved throu
attacking commerce, or menacing the littoral, its operatio
will be governed. If the main body of the fleet avails
positions, strategically good both for entrance and exit
evasion, and holds itself in hand watching for any chance th
may transpire to equalize its strength with one or more fractio
of the enemy's fleet either through accidents, mistakes, or t
compulsions of the situation, it will be in a far better positi
if covered by coast defenses. An inferior fleet in Long Isla
Sound, for instance, would be little better off without co
defenses than if it were in the open, except for the great adva
age conferred on it through the two exits. In Chesapea
Bay it would be no better off, experience going to show tha
fleet attacked at anchor or in a confined space is taken at a gr
disadvantage, unless covered or supported by fortifications, a
even then the dispositions for mutual support must be most sk
fully made. The torpedo vessel has made the position of
anchored fleet most perilous.

It is certainly wrong that upon a single military arm shou
be laid the task of defending the coast. It being admitted th
the first fighting line should be kept as far from the coast
possible, that is, on the enemy's coast,—the contemplation
the fact that from any cause it will be unable to entirely occu
the enemy's fleet brings at once to the mind coast defenses.
other words, the so-called first line of defense should not be t
only line of defense. On the other hand, to repeat, it is som
what difficult to see what essential part seacoast fortificatio
could play in defense if there was no fleet. The paramou
relative importance of a fleet in a system of defense is frequen

lost sight of, and people in some way get the idea that fortifications by themselves in a way add to our stature or strength,—that they can do something in fact. Yet the whole coast might be made to bristle with guns, and still not add to the impressiveness of an international demand. The addition to the naval strength, however, of a few battleships has a remarkably far-reaching and persuasive effect. It is certain that our fortification schemes are simply noticed by foreign nations, while our naval policy is keenly watched. Though the coast of Belgium is clad in iron, it is difficult to see why, unless it is allowed that certain contingencies calling for alliances are looked for. But so far as national defense is concerned by that nation alone, all those fortifications are but so many tons of iron. They, however, may be but the part which Belgium contributes to the general European guarantee of her neutrality. In another sense perhaps, permanent fortifications possess a fictitious value in the minds of the peace-loving peoples. The doctrine of minding one's own business or of non-interference, engenders the spirit of passive resistance of which fixed defenses are the exponent. Our peace-loving nation may be content to rest behind such defenses, forgetful that an attitude always passively defensive is bound sooner or later to give way and break down. The most cautious, if able, general, on the defensive, simply waits the opportunity to assume the offensive, which in his hands becomes the most perfect defense, and it may further be said that to assume a merely passive defense on the ground that an active offense is hopeless, simply allows an enemy to gain his objective, eventually, with much less material loss. When a fleet covers itself behind passive defenses, the enemy has already gained much that he should have been compelled to fight for. In the national policy for defense, the permanent defenses and the mobile defenses should be grouped together and should go hand in hand. There should be no separation in their interests or in their treatment, as there is none in fact; and this consideration leads to the conclusion that all the means conducing to national defense should be treated by the same general head, not necessarily by one person, but there should be a community of interests secured by a common supervision. In the case of powers having a colonial policy, the relationship is perhaps more in evidence than has heretofore been the case with the United

States, where the sea frontier, until recently, marked sharply the line drawn between the two arms of the service. As regards over-sea colonies, it is impossible to separate their defense from a consideration of the naval forces. A coaling station has no reason for existence except as a depot for the fleet.

It may be of interest to examine into some of the causes which occasionally gave such brilliant and signal success to vessels opposed to fortifications, as bearing upon the complete and radical change which has taken place in the principles of placing and construction of coast batteries.

The evolution of the coast battery may without sensible error be assumed to have been something after this manner. First a gun or guns placed at the water's edge as low down as possible, with the object of attaining the full effect from the ricochet of the spherical projectile, as well as to increase the accuracy of the fire of the guns by getting as close as possible to the ship; the range and danger space by this means being enormously increased. The number of guns increasing, a desire for economy and concentration placed the guns in one work, and the same reasons added tiers of guns to the battery. There was also present the idea of repeating in the battery the well demonstrated offensive powers of the many-decked ship, and such a combination formed, at that time, greater defensive properties. Single tier batteries at the water's edge were frequently commanded by the upper deck guns of the heavier ships. The concentration of the guns of the day, with all their inaccuracies, in one position gave these batteries chances of inflicting damage at their effective ranges, which ranges being extremely short, enabled the batteries to be more easily defended from a land attack. The same held true with the ship. If a line-of-battle-ship of the early years of the century could range up to within point blank of such a work unmolested, and anchor, the amount of metal she could deliver with every projectile hitting, was remarkable. In the case of a 100-gun ship for example, a few figures will illustrate. Such a ship as the Queen Charlotte, in 1794, would carry on the main deck thirty 32-pounders, on the second deck twenty-eight 24-pounders, on the third deck thirty 18-pounders, on the quarter deck ten 12-pounders, and on the forecastle two 12-pounders. In addition, such ships in the

British navy always carried from eight to ten carronades, usually 32s and 34s, six of the latter and two of the former. The total weight of metal that a 100-gun ship could throw in a broadside was 1292 lbs., and it was reported a common performance to do this once in a minute. It follows that in five minutes she could deliver, against larger fortifications with every shot telling, 6460 pounds of metal. This rate of fire is commonly assumed to have been practicable in those days, but in Collingwood's flagship, the Dreadnaught, before he took the Royal Sovereign on the eve of Trafalgar, it was thought good work to fire three well aimed broadsides in five minutes and a half. Well aimed broadsides, however, were hardly required when a vessel could be laid within from 100 to 500 yards of a large masonry fortress. It was impossible under such circumstances to miss the work, at such ranges every shot told, and in many cases vessels had been permitted by coast batteries to take such positions favoring them in the extreme. The Queen Charlotte engaged within fifty yards of the batteries at Algiers in 1816.

A comparison of the fighting efficiency of the old type line-of-battle ships with those of the present day may not be amiss in this place, especially having regard to their comparative efficiencies when brought in contact with coast works. It goes without saying that the old ship has no place to-day against proper coast works, even though she were a steamer. But it is a matter open to serious question if she were not, in her day, relatively more efficient in such actions than the present battleship. While perhaps no greater rapidity of fire was attained in the time of the Crimean war with the same type of guns than in the beginning of the century, nor had the number of guns increased, yet the volume of metal thrown had decidedly increased. The Caledonia of the later date carried 120 guns; twelve 8″, firing 56 pound shot, and one hundred and eight 32-pounders. She was able to deliver at a broadside 2064 pounds of metal. The Victoria, a screw steamer of the same period, carried 121 guns all told; sixty-two 8″ or 56-pounders; fifty-eight 32-pounders; and one 68-pounder pivot; thus firing in one broadside 2732 pounds of metal. Our first frigates built after the War of 1812 threw a broadside of 2406 pounds. A comparison of recent battleships, where figures are available, will bring out some significant facts. It will be noticed that the number of larger

sized rapid-fire guns supplied to the more recent vessels exhibits a decided tendency towards a return to the efficiency peculiar to the old ship, in which rapidity and volume were gained by numerous guns, and accuracy was obtained by fighting at short ranges. Taking the Irresistible, for example, which on a displacement of 15,000 tons carries four 12″ guns, twelve 6″ rapid-fire eighteen 12-pounders, twelve 3-pounders, and eight machine guns. Assuming five minutes as the unit of time, the number of rounds that could be fired would be for each gun approximately as follows: 12″ guns, one; 6″ guns, twenty; 12-pounders, thirty; 3-pounders, fifty. This would permit a delivery of six hundred and ninety-four shots and 19,540 pounds of metal in five minutes. The Victoria in that length of time could probably have delivered nearly five broadsides of 13,660 pounds of metal, the number of shots being 305, which is not such a wide difference as might have been imagined.

The draft of water of the old ships, especially the English, did not differ greatly from that of the present battleships of the second class. The displacement, however, was much less. If the vessels of the two epochs be compared by displacements, the balance in favor of the old ships would be very great, indeed, so far as the volume and intensity of fire at effective ranges goes.

If it is allowed that the 12″ guns of the Irresistible can be aimed and fired once in five minutes, it would probably be an average performance. The twenty-nine ton gun cannot fire more than twice in the same time. The hand worked gun on the Thunderer of the same size (29 tons) fires in practice, once in one minute and ten seconds, unaimed rounds however. The 6″ guns, not rapid-fire, do very well firing once a minute, better than ordinary practice shows. Twelve times a minute is a very favorable allowance for the 6-pounder and 3-pounder. Of course a comparison with the most recent ships would show a great advantage over the old ships, as the number of guns and the rapidity of fire have greatly increased. The battleships of our latest class will carry perhaps seventy-four guns, all of them rapid-fire except the turret guns,—but the comparison made, however, will serve to make clear how very efficient the old ship was against fortifications in plain sight at short range, while the modern ship must contest with almost invisible defenses at greater ranges. Another interesting comparison has been insti-

tuted by Lieutenant-General Pestitch of the Russian Marine Artillery, which tends to convince us that the old arrangement made a ship a more efficient fighting machine relatively speaking, apart from the considerations I have tried to give, than the modern battleship. He takes as his base of argument the proportionate weights of artillery compared with the other features of vessels, and from such an examination of his figures as was possible, there is no doubt they are very accurate. For instance, before the beginning of the present century the proportionate weight in tons of artillery to displacement in the case of a 100-gun English ship, he states was 23 to 100; later, it fell to 21 to 100, and later still, in the case of the Paris in the fifties to 18 to 100. In modern English ships the variation in the types is great. In the turret class of English ships it varies from 8 to 100 to 4 to 100, in citadel ships from 8.8 to 100 to 5 to 100. For protected deck cruisers from 6.5 to 100 to 5.5 to 100. The French ships show nearly the same percentage. The nine largest Italian ships are stated as carrying 11 tons of ordnance to 100 tons displacement. The figures are difficult to arrive at upon which to base accurate calculations, but when we consider the nature of modern fortifications, wherein it will be necessary to hit small objects with but short intervals of appearance, and only occasionally will large heavy targets be offered, it may be said in general terms that the ship, which is provided with a rapid-fire battery up to the utmost limits of weight which the conditions of rapid-fire impose, is better fitted in the sense of offensive power to cope with coast works. The tendency in modern ship construction is certainly in that direction. The heaviest guns are being decreased in size and weight towards the limit imposed as condition of rapid-fire, and the lighter guns are increasing in size and weight towards that limit. As we take the still later designs of ships, the results are very apparent. The five minute fire of the Royal Sovereign which can be directed on one point is approximately 17,000 pounds; that of the Marceau 14,644 pounds; the Iowa 12,500 pounds, the Woerth a little less. The Jaureguiberry, however, having but three heavy guns in broadside, falls to 8818 pounds, and in the Iowa we have better results than in the monstrous Italia of an older date, by about four hundred pounds. A few illustrations, though they cannot be taken without suspicion, will corroborate General Pestitch's figures.

The Warrior class of vessels were allowed 400 tons for ordnance on a displacement of 7256. The Blake of 9000 tons allows but 486, the Duillio on 10,401 tons, 984. The Riachuelo of 5685 tons displacement was allowed only 300 tons for ordnance, meaning guns, small arms, turret engines, hydraulic apparatus, and other gear, while the weight allowed in the old Victoria for guns and carriages alone was 357 tons. Formerly, the whole ship was a gun carriage, the motive power not interfering with the artillery in any sense except in that of its weight. No gun space was occupied by the motive power. The necessity for carrying coal, machinery, and armor has reduced the weight permissible for artillery. All economic improvements giving extra allowances, the General claims has gone to armor and big guns, and to increasing the speed. By weight of artillery in his calculations is to be understood the total allowances for ordnance. The General was present at Sebastapol and thinks the vessels would have done better with a larger number of smaller guns. As regards the efficiency of a vessel in attacking coast works, speed is the last factor to be considered. The one great thing is the effect produced by an intense and accurate fire from many guns.

History recounts but few instances of the single-handed engagement between a ship and a fort. The fort was usually outnumbered greatly in gun strength, and, further, in the engagements that have taken place between ships and forts, there has generally been a noticeable difference in the fighting efficiency of the personnel of the two sides. In our Civil War the conditions were somewhat different. There was a perfect equality in the temper of the opposing parties. The most brilliant achievements of vessels against coast defenses, were the simultaneous passage and silencing of fortifications or the passage alone in the face of inefficient obstructions. In other respects, fortifications proved again and again their superiority and efficiency, and frequently, perhaps always, it was the improvised works, fortuitously placed while supporting each other and stubbornly fought, that gave the best account. In some cases, the powers of resistance of simple earthworks à fleur d'eau were remarkable, especially when pitted against the slow firing monitors. Even when the odds have been greatly against the works on shore, there have been few occasions where the success of

the fleet cannot be traced to the inefficiency in numbers or temper of the defenders themselves. The Southerners set themselves an impossible task and many people are prone to-day to set themselves the same task. The effort was made to fortify every vulnerable point of the coast line, and with their own resources and those secured in the navy yards in the South, they were able to make a showing to that end. The result was that their efforts were disseminated over the whole coast line, and naturally they could not be strong at all points. Every point was thus weakened in personnel, and when the strain was brought at one or more points it was generally impossible to relieve it. Greater powers of mobilization would have helped matters in respect to garrisons, but a more concentrated system deliberately worked out would have been more rational and, it cannot be doubted, more effective.

An examination into the circumstances surrounding a few famous engagements between ships and coast defenses, more particularly those wherein the ships have been successful, may serve to elucidate the principles of coast attack and defense involved. Of course conditions have changed, but perhaps not to so great a degree relatively. At any rate, experience is the only guide we have, and when we find history telling us that the cases wherein ships without the landing force have been successful over coast defenses, are the exceptions and that there is a long line of successes the other way, an investigation of the events can only aid us to form proper ideas concerning such actions, and properly to estimate their risks and chances under new conditions.

In Lord Exmouth's famous action at Algiers in 1816, though the opponents were wary and skillful, he was permitted, unmolested and before a single gun was fired from shore, to anchor his flagship by the stern,—lashing his vessel, the Queen Charlotte, at the same time to an Algerine brig at anchor and within fifty yards of the mole batteries, his whole fleet following into its position. In taking its position, the whole fleet was compelled to pass under a range of powerful batteries. The position the flagship was allowed to take, enabled her to enfilade the whole line of bateries on the mole. The engagement which lasted from 2.45 to 11.30 P. M. resulted in what was called, and was in fact, a brilliant victory for the fleet, but it may be and has been

questioned, if people of a different temper than the Algerines would not have changed the course of the affair. The first error committed by them was in permitting the fleet to take its fighting position unmolested, while it could have been under fire at all ranges in the position most unfavorable to it; i. e., while it was approaching end on to take position and when it could not return the fire. The whole number of guns mounted throughout the city both for land and sea defenses amounted to probably more than 1000, though it cannot be ascertained that more than 320 could be brought to bear on the fleet. The possibilities are that not more than 200 bore. The Algerine men-of-war inside the mole were four 44s, five 24s, or 30s, and a number of gun and mortar boats. The allied fleets mounted nearly, if not quite, nine hundred guns and comprised a number of gun- and mortar-boats, and special vessels for firing Congreve rockets which succeeded in destroying the Algerine vessels and setting fire to the arsenal and other buildings. At 10 in the evening, the commander-in-chief seeing that the batteries around his division were "in a state of perfect ruin and dilapidation," determined to withdraw and says, "Providence at this interval gave to my anxious wishes the usual land wind common in this bay, and my expectations were completed. We were all hands employed warping and towing off, and by the help of the light air, the whole were under sail and came to anchor out of reach of the shells about two in the morning."

James says that the upper tiers of the batteries were in a state of dilapidation, the fire from the lower tiers nearly silenced, and the ammunition of the fleet short when it commenced to withdraw, he also speaks of the wind which "fortunately for the British had just sprung up." The Algerines gave in to the demands of the British the next morning without further resistance. The allied loss was 144 killed and 742 wounded. The Algerines' loss estimated at from 4000 to 7000.

Lord Exmouth speaks of a little battery on the upper angle of the city on which the guns of the fleet could not be brought to bear, which annoyed the ships. The fleet in this action expended 500 tons of shot. The Queen Charlotte from her close position so kept down the fire of the opposing batteries that her losses were very slight comparatively, eight killed and 131 wounded. The Impregnable at from 1200 to 1500 yards, how-

ever, suffered severely, there being 50 killed and 138 wounded, the vessel besides was seriously damaged, and only those vessels that were able to close, silenced their opposing batteries. The tactics employed were to pit ships as closely as possible against a portion of the sea forts, the mortar vessels being held at about 2000 yards distance. Through untoward circumstances it was impossible to fully carry out the plans, hence the position in which the Impregnable found herself.

When Napoleon at St. Helena heard of this engagement, he said to O'Meara that the matter might just as well have been settled by blockade. "There are no other seamen (except the Americans) who would have done what yours (the English) effected, or perhaps have attempted it. Notwithstanding this, and that you have succeeded, it was madness and an abuse of the navy to attack batteries elevated above your ships, which you could not injure; to contend against red hot balls and shells, and run the hazard of losing the fleet and so many brave seamen against such canaille." Napoleon all his life gave especial attention to coast armaments and organizations.

The light wind which happily sprung up for the fleet, undoubtedly was a large factor in the ultimate success. So far as it is now replaced by steam, just so much more certain may the results be considered. The ability conferred by steam propulsion to withdraw at such decisive and critical moments is an incidentally great advantage for the attack, so long as the power to move at will remains.

Some thirty-nine or forty gun-vessels took part in the struggle on the Algerine side, as harbor defense vessels. When they could be made out through the smoke, thirty-three of them were promptly sunk by the superior fire from the ships. In the lack of much historical data as regards the efficiency of gunboats in coast defense, this item is given for what it is worth. It is pertinent to imagine what more the fleet could have accomplished if the Algerines had not given in without further resistance. Close action was absolutely essential to the fleet,—and there are many indications that the same holds to-day,—and its ammunition was dangerously low, immense quantities had been used, and the result was that the fleet was thankful to get out of range.

At Acre in 1840, the British fleet under Admiral Stopford was

allowed to sound, lay buoys, and take its chosen position unmolested. The tactics pursued were similar to those in Algiers, to attack on two sea faces, leaving some of the batteries masked. This victory was rendered easy from the very weak resistance offered. It is not necessary to detail the circumstances further than to quote the opinion of the Duke of Wellington concerning it, that " this was a singular instance, in the achievement of which great skill was undoubtedly manifested, but which was also connected with peculiar circumstances, which they could not hope always to occur. It must not therefore, be expected, as a matter of course, that all such attempts in future must necessarily succeed." Another successful operation of ships against forts was that of San Juan d'Ulloa, reduced in 1838 by Admiral Charles Baudin. The work of San Juan d'Ulloa was a rectangular, bastioned, casemated fort on the edge of the reef of Gallega, facing the City of Vera Cruz, and separated from it by a narrow strait, 1000 yards broad, and about 20 feet deep. Another narrow channel on the opposite side separated the reef from the small narrow island of Galleguilla. The fortress was built in regular fashion, and mounted one hundred and ninety-three guns. The squadron consisted of the frigates Nereide, 52; Gloire, 52; Iphigenie, 60; corvettes Creole, 24; Naiade, 24; Gabare, Sarcelle; bombardes Cyclope, and Vulcain. Reconnoisances were made by night, under direction of the admiral, the parties approaching very near the fort. The best place for the attack was chosen where the water was calm and the fleet would be under the fire of a minimum number of guns.

The bomb vessels having arrived on the 27th of November, 1838, the Nereide and the Gloire were towed into their positions under sail at about 1300 yards northeast of the work, within about 100 yards of the edge of the reef. The bomb vessels Cyclope and the Vulcain were towed between the two reefs, anchoring at a distance of 1600 yards from the work. The Creole was allowed to fight under sail. The Naiade and Sarcelle were placed to the northward to observe the fall of the projectiles and correct the ranging, in the trial shots. The three frigates were so placed that only the small number of twelve guns could be brought to bear upon them. They were allowed by the Mexicans to take their positions deliberately and to spring their broadsides into the most favorable position. The action was

commenced by the frigates at about 3 P. M. The wind was very light, and after a short time the works and the ships were covered with smoke, compelling a cessation of fire on the part of the vessels. The corvette under sail, the Creole, found it difficult to keep in position in shallow water, and she was moved into the channel between the two islands and continued the action under sail. About 4.30 some mortar shells from the vessels caused the explosion of a magazine as usual, and caused the batteries in the neighborhood to cease, after which the fort fired only occasionally. In the evening the fort asked for a suspension in order to care for the dead and wounded. This request was refused and the capitulation of the fortress was demanded under threat of renewing the bombardment in the morning. This proposition was referred to the Commandant at Vera Cruz, and while the fleet were getting into position again the next morning the terms were accepted.

It is unnecessary to look further into this action. It was undertaken by Admiral Baudin, at a time when all the world believed the works impregnable in an action with ships. His biographer says that the mortar shells broke in the roofs of the magazines, that the fire from the batteries was continuous, and that the explosions alone carried discouragement to the garrison.

The French chief of engineers noted that there was no breach in the scarps, and that none of the casemates had been broken in; and that, at the moment of capitulation the frigates were upon the point of retiring. He says that, "The besieged should have seen that we were unable to breach the walls or to destroy their casemates, and therefore, our inability to take the fort by a simple bombardment." It seems that the principal magazine was intact.

The Duke of Wellington is reported by the same biographer as having said that it was the first instance he had ever known of a regularly fortified place having been reduced by a purely naval force. It is probably a misquotation in the face of Lord Exmouth's affair at Algiers in 1816; and two years later the affair at Acre took place upon which he expressed himself as previously quoted. The wonder is that the attempts succeeded at all. The crews of Admiral Baudin's fleet were weakened by yellow fever and the stringent need for water, and the material odds were all against him, but whether the Mexicans fought well or ill, the action of the admiral was notable.

The siege of Charleston, beginning in 1863 and continuing to 1865, is replete with interest, but the subject is very controversial and somewhat indeterminate. It has been stated that the iron-clad fleet could have gone up to the city at any time, that the character of the obstructions were such that they would not have prevented the fleet passing through the lines, and that the three, successive centres or zones of concentrated fire so much relied upon by General Ripley, could also have been successfully passed. The question in that case is what would the fleet have done when it arrived off Charleston city. The batteries would still have been in existence in its rear.

Captain John Rodgers of the Navy expressed his opinion on that point very clearly before a senate committee in February 1864. "Ordinarily and popularly, to take a place means to take its defenses. General Gillmore was forty-eight days on Morris Island, acting against Fort Wagner, with some 10,000 or 12,000 men against a garrison of about 1500, more or less, assisted by the monitors and by artillery which excited the wonder of Europe. . . . He took the place, not by his artillery nor by his monitors, but by making military approaches and threatening to cut off their means of escape and take the place by assault; and when he took it, it was not so greatly damaged as to be untenable.

"Now, if General Gillmore, on the same island, assisted by his artillery and the whole force of monitors in forty-eight (or fifty) days, could not capture Fort Wagner alone by them, it is perfectly certain that the monitors alone can never take the much stronger defenses which line James Island and Sullivan's Island. In going up to Charleston therefore, he would have to run by the defenses, and leave the harbor, so far as they constitute the command of it, in the power of the enemy; and when he got up to the city he could not spare a single man from his monitors even if they should consent to receive him; and if he burned the town, he would burn it over the heads of non-combatants, women and children, while the men who defend it are away in the forts. I should be reluctant to burn a house over a woman's and child's head because her husband defied me. Dahlgren if he burns Charleston, will be called a savage by all Europe, and after the heat of the combat is over he will be called a savage by our own people. But there are obstructions in the way which render

it doubtful whether he can get there, and if he goes up under the guns of those fortifications, sticks upon the obstructions, and is finally driven off by any cause, leaving one or two of his monitors there within their power, they will get them off, repair them, and send them out to what part of the coast they please, and give a new character to the war.

"The wooden blockade will be mainly at an end, unlimited cotton going out, and unlimited supplies coming in. I see no good to compensate for that risk, except it be in satisfying the national mind that retributive justice has been done against the city of Charleston. . . . In a word I do not think the game is worth the candle. Whether these reasons operate with him, I do not know, they would with me."

Leaving aside all the disputed points it is perfectly certain that the fortifications were too much for the fleet alone; that the landing force actually engaged, until the approach of Sherman's army, was inadequate, and that the nature of the country precluded the possibility of taking the city and works by a flank march. Could a sufficient body of troops have operated in such manner on the communications of the line of defenses, the place must have fallen.

One other engagement between ships and shore defenses will be noticed, not for its value as a study which is very great, but from the notoriety it gained, and the influence it had upon the character of coast defenses. The one referred to is that in which the Pompee of eighty guns, Sir Sydney Smith, the Hydra, thirty-eight guns, and the Aurora, twenty-eight guns, engaged in 1806 for a considerable time a small two-gun round tower battery placed well above the level of the sea at Cape Licosa. The Pompee fought at anchor at a range of 800 yards and the other two vessels fought under way. The battery was manned by twenty-five French soldiers commanded by a Lieutenant, a Corsican relative of Napoleon's. At the second round from the battery one of the two guns was dismounted and was afterwards fired resting on the ground. The ships nearly exhausted their ammunition. The Pompee was hulled forty times, her mizzen topmast was carried away, seven were killed and thirty wounded. A small detachment of marines supported by two small field pieces went ashore and the work capitulated.

These examples taken at different periods, illustrate rather

fairly the conditions under which such engagements between fleets and forts have taken place in the past. The three of Algiers, San Juan, and Acre, are a few cases, wherein the fleet has succeeded unless the landing force has appeared. There are many cases where the great power possessed by a few guns with weak cover has made itself felt. As a modern example of this, there is the very recent one of the bombardment of the fortifications at Santiago de Cuba. These consisted of four 15 cm. Hontoria B. L. Rifles, several machine guns and a few very old bronze smooth bore guns which had been rifled to fire a shell of about seven inches, and five muzzle loading 8" mortars. The works were constructed of barrels and boxes filled with concrete reenforced with earth forming the faces of the forts—yet they withstood the repeated attacks of the blockading squadron which for the greater part of the time consisted of the first-class battleships Oregon, Indiana, Massachusetts and Iowa, the armored cruisers New York and Brooklyn, with the addition at other times of the protected cruisers Newark, New Orleans and Marblehead, the auxiliary steamers Dixie, Suwanee, Vixen and Gloucester. It is true that none of the bombardments were expected to destroy the works or to force a capitulation, but only to harass the enemy and do him as much injury as possible. The ranges used varied from 2000 to 3000 yards, and with the exception of knocking one gun off its carriage; temporarily disabling another, and generally burying the remainder under the earth thrown up by the exploding shells, no damage was done which was not immediately repaired.

Wherever there has been anything like an equality, however established, especially in the personnel, fortifications have had a remarkable history of success; and there are authentic accounts other than those given, in not very distant times, which are almost incredible, tending to exhibit the remarkable superiority of guns on shore. In such cases also an equality in the character of the personnel is to be noted as well as the fortuitous placing and character of the battery. All these instances taken with the known reasons have induced engineers to place coast works, whenever possible, so that they shall have a distinct command. The single reason before stated in favor of low placed batteries, that of increasing the range and dangerous

space through ricochet firing, in the smooth bore era, has with modern ordnance a parallel now in the desire to deliver a direct heavy armor-piercing blow,—but up to certain limits, high command favors that as well. The reasons for giving high command to guns are many, and have regard both to the offensive and defensive character of the work. The target offered is greater in area, there are more chances of a deck hit at all ranges; and one reason, flowing from the immunity offered by high sites, is the unrestricted arc of fire thus secured. The most urgent reasons, however, have to do with defense and the security to the gun detachments.

The naval wars of recent years have decisively settled the point that earthworks are the very best cover. Experiments, in addition, have confirmed the results of experience. Masonry has had its day and the expedient of facing masonry with armor is not favorably looked upon by engineers, although the rigid backing offered by the masonry seems to increase the resisting powers of the armor applied to it. It is doubtful if such armor faced batteries will ever be constructed in the future, though existing casemates, well placed according to modern requirements, may be utilized in that manner. Casemates have many objectionable features peculiar to that form of battery; the restricted arc of fire permitted by the embrasures, the difficulty in aiming, the accumulation of smoke in them, the limit to elevation, their expense, if made of sufficient resisting powers, their weakness about embrasures, and the exposure of the chase of the gun during the entire time under fire. On commanding sites they are not necessary. In places where such sites are not available, recourse may be had to various other methods of mounting guns under cover. Among all the different methods proposed, there are but a few general types. Casemates, turrets, disappearing mounts, and barbettes with or without shields. Turrets are open to the same objections as casemates. They have, however, the advantages of an all around fire, and offer the most complete protection to the gunners. The fact that two guns mounted in one turret operates to lessen the item of cost as compared with efficiency. The cost, however, remains enormous, and turrets should be resorted to only when no other method can possibly be made available.

At a time when heavy guns and turrets were in form, a Mr.

Anderson, C. E. stated his belief, in a lecture before the R. U. S. I., "That the Dover turret would be so damaged by a single 16″ shell that it would be impossible to work it any more. The energy of one of the bolts of the Inflexible striking, say at 2000 yards range, would be represented by the whole of the Dover turret, which weighs 750 tons, rising sixteen feet in the air. Is it conceivable that no derangement would result from such a blow?"

The effect of a blow upon the chase of a turret gun delivered on its side, through the leverage, in putting out of action the turret and guns has not been considered, however. Disappearing mounts are of many different descriptions, and present many distinct advantages, together with some disadvantages. The problem of their application to the heaviest ordnance has been satisfactorily solved. They are relatively much less costly than either casemates or turrets. The personnel serving them is as perfectly shielded as possible. The gun itself is only exposed for the instant of firing, and they are applicable to all sites. Apart from the moment the gun is exposed, the only target offered is a horizontal one, completely invisible from any position a ship can occupy, and in conjunction with a horizontal shield the gun can hardly be injured. The arc of fire can be made sufficiently wide, and any elevation desirable can be used. On the other hand, guns so mounted require the most complete application of every system of range and position finding, and the utmost nicety and precision in their action. Earthen barbette batteries possess all the advantages of the others with the exception that the gun is exposed more to direct hits from all calibres of guns, and on low sites the difficulty in the way of covering the gunners is very great, but by applying horizontal covers, the protection is considerable. It is evident that the greater the I. V. the more the range will have to be increased in order to obtain even a hit against any part of a gun so mounted, let alone the carriage or its detachment. With an angle of fall of 4° the shell, or projectile of any kind, would strike the ground with a height of parapet of 10′, at a distance of but little less than 144′ behind the parapet, and at only 72′ from the crest would the projectile pass within 5′ of the platform on which the men are stationed. In order then, to obtain any serious results against a gun so mounted, other than a hit on the muzzle or

chase of the gun, or the weak point of the crest the ship must remain at a distance.

It will be interesting to note a few figures taken from a series of curves designed by an English naval officer as illustrating the value of high sites for barbette batteries. The gun was a 27 C. M. (10.6″) French B. L. gun. The shell was of 476.2 pounds weight, the i. v. having been 1664 f. s.

Height of Battery.	Range.	Angle of Fall.
100′	500 yards	+4°
	1000 "	+1°
	1300 "	Horizontal
	2130 "	—2°
	3030 "	—4°
200′	1720 yards	Horizontal
	2640 "	—2°
	3170 "	—4°
240′	1860 yards	Horizontal
	2590 "	—2°
	3350 "	—4°

For a battery elevated 100′ above the gun, the shell fired at a range of 500 yards will arrive at the crest with an angle rising of about 4°.

The increase in velocities and flatness of trajectories has operated in some ways to reduce the danger to be feared from shrapnel fire. In the first place in order to be effective against such a work the shrapnel must burst at one particular instant before and over the parapet. The increased velocity has manifestly decreased the chances for such a burst, which was always a matter of great uncertainty, and again, borrowing from other English experiments and writers, the results of experimental shrapnel fire with H. P. B. L. rifles give angles of opening for shrapnel fired from a 12″ B. L. R. at 2000 and 3000 yards as 4° 34′, and 4° 40′ respectively. Taking the case above of an angle of fall on arrival at the crest of 4°, which could only be the case with a range of 3170 yards for a battery elevated 200′ (this for a 10.6′ gun, however) the lower branch of the cone of dispersion would have an angle of fall or drop not greater than say 4°+5° =9° and only at 32 feet inside the parapet would be shot pass within 5 feet of the platform. These results of course would

show an increase or decrease in proportion to the initial velocity of the projectile. By the proper placing of such an earthen battery, it can be given a wide arc of fire, and be very little subjected to a raking fire. The thickness of earth necessery to keep out all projectiles and to prevent the craters formed by the explosion of shells in the parapet from destroying the crest when the slope is at a proper angle, is variously estimated at from 30′ to 70′. Of course when earth is at hand of proper quality no limit is placed upon the thickness. The bombardments of Alexandria and of our own war furnished all the data needful when combined with extensive experiments carried out in England and elsewhere. A certain kind of loam or crystalline sand seems to offer the best substances. The only hits upon such a parapet that are supposed to be effective are those of shell exploding just on or after striking the crest and throwing in on the gun detachment all the dirt and debris, and for such hits the flat trajectory is not adapted, as it tends to bring the effect of the shell along the line of greatest resistance.

Concerning penetrations into earth works Major Clarke says: "Tables of penetration into earth and sand have found their way into various text books with no words of qualification. It is hardly too much to assert that they are totally misleading. Whatever may be the penetration obtained in specially constructed butts, or arrived at by calculation open to objection, it is now sufficiently established, that parapets of earth or sand with exterior slopes, will not hold projectiles so as to enable them to penetrate properly. At Alexandria, the penetrations judged from a large number of examples, were extremely slight. The shells turned up at once and either ricochetted high over the works, or were stopped and lay on the superior slope base to the front. A 16″ shell from the Inflexible, fired at under 2000 yards range was stopped after penetrating less than 20′ of sand. As might be expected, this tendency to be immediately deflected is still more marked in the case of the new B. L. guns at Eastbourne, an 8″ B. L. Palliser shell fired at 1193 yards gave a penetration of only 6′ into a loam parapet with an extreme slope of one in two. At Lydd, the effect of three 9.2″ B. L. Palliser shells fired at 1200 yards against a similar parapet, was almost nil." While on this subject it is well to recall what Captain Goodrich has to say concerning the earthworks,

as what he has said has exerted a powerful influence upon the consideration of the subject; "There can be put two targets at which it is worth while to direct their (vessel's) fire. The first is the muzzle of any gun actually served; the second is any building known or believed to be a magazine or shell house which is visible above the parapet." Rear Admiral Lord Charles Beresford says regarding the action at Alexandria, especially about Fort Mex: "A barbette fort is the most difficult one to hurt because to hurt it, you must put its guns out of action, and where you have only a gun pointing over the top of the fort you have to put your shot into the muzzle of that gun to put it out of action. If he is firing at you all the time it rather disconcerts your aim, and your shot will either hit the parapet or go over the top."

Apart from the almost universal experience in the Western rivers of our vessels when engaged with high placed batteries, there was an instructive brush which has been widely quoted,—that at Drury's Bluff on the James River, several miles below Richmond, in May, 1865. The bluff was about 200 feet above the river and the batteries mounted three Rodman guns (8″) bearing on the river, commanding a long reach of the river, in which two lines of obstructions had been placed,—a row of piles and sunken vessels. The Galena and a monitor anchored within 600 or 800 yards, the monitor nearer at first, but she had to withdraw to a position where her guns could be given sufficient elevation. The three wooden gun-boats anchored at 1300 yards distance. The action lasted nearly three and one half hours, at the end of which time the ammunition of the vessels was exhausted. The Galena suffered severely, both in her hull and in losses among the crew. The works do not appear to have suffered but slightly. Of course, to repeat, there are many localities which do not afford sites favorable for earthworks with command, in which case resort must be had to other methods of mounting and cover.

In view of the many advantages offered by the disappearing system, turrets should only be resorted to where no other possible method can be used. Where a work is required to be built on a low site, surrounded by water, or where it is thought necessary to place a work even where the site is under water, no other form of fortification seems available. One drawback

to a high site is the dead angle in the space in range nearest the gun, because when the height of parapet is increased to further protect the gun and detachment, this dead angle becomes greater as the depression of the gun is more restricted. In positions where the channel leads at some distance from the height upon which the battery is placed, it can be disregarded. Where the water is deep under the battery, the situation requires the careful consideration of the engineer. Where the surroundings are such that a low piece of land lies between the foot of the height and the water, the engineer must carefully weigh the relative advantages existing between a high battery well withdrawn or a low battery further advanced.

Concerning the question as to whether the guns should be grouped or dispersed in coast defenses, the modern practice is to separate them to such an extent that their mutual support is not endangered. Heretofore, questions of economy and the security of the garrison against a land attack or a coup-de-main, have kept the guns concentrated in the neighborhood of a keep or redoubt. Now, by dispersion within the limits of mutual support, the important feature of invisibility is enchanced; the injury of one battery does not entail disaster to another, and improvements in communication, observation, and range finding together with the accuracy of modern ordnance have neutralized all the advantages which were formerly secured through concentration of material. The smoke of one battery does not mask another battery or reveal its position. The dispersion of the batteries also favors cross fire, and a vessel may find it impossible to take an advantageous tactical position, for when end on to one battery it may find others engaging it on its broadsides. If the muzzles of some of its guns are presented to one battery, forming the minimum target, others may be exposing their chases to damage from another battery. In regard to the importance of invisibility for gun mounting in shore batteries, one British official report concerning the Alexandria bombardment states that, " One rifled gun in the hospital earthwork which it was impossible to dismount, being invisible from the ship, did us great damage." Captain Goodrich also states that the British gunners were greatly aided in their pointing by the contrast between the black muzzles of the Egyptians' guns and the light color of their masonry parapets.

Speaking of this feature of placing of batteries, it is authoritatively stated that the Malakoff battery gained greatly in efficiency after the tower which gave it its name had been reduced to a shapeless mass. While it existed, it was a mark for aim and a constant danger to the battery beneath.

The tactical discussions as to the influence of smokeless powder in future engagements, whether the attack or the defense will be most benefited, while interesting, hardly seems to be pertinent as between ships and forts. Whether the ships will or will not be benefited by its use is also unimportant in view of the immense advantages conferred on the passive defenses. If all the means tending to the masking of shore defenses are utilized, we now have the assurance in using smokeless powder that shore guns can remain absolutely invisible from ships. General Sir Evelyn Wood in reporting on experiments made to test this fact says that after a battery had been firing a long time rapidly with cordite, that it was absolutely impossible to locate it at a distance of a mile and a half.

In placing batteries, then, the engineer is governed by certain conditions; they should be dispersed; the fire intended for one battery should not reach another; the guns in each battery should be so placed that the chances of a raking hit are minimized. These results are accomplished from a knowledge of what positions ships must take, and protection is further offered by traverses which equally prevent injury to one gun involving others. It is not deemed advisable or necessary to give seacoast batteries much passive protection from land attempts. There is a danger in closing such works to the rear in confining the explosive effect of shells falling within them to the locality where they produce the most damage, and they should be allowed free passage to the rear.

The defenses against land attack upon isolated batteries are best in the hands of infantry and light artillery armed with the magazine rifle and machine guns.

When engineers have the problem of protecting or fortifying a particular harbor before them, they have first to consider the probable magnitude of any attack that may be made upon it. Certain places are of sufficient strategic or even intrinsic importance to warrant perhaps the assumption that a large portion of the maritime resources of any probable or possible enemy may

be liable to be brought against it. Again there are places where it is equally certain that the enemy would not send a man to do a boy's work. Having determined such matters satisfactorily, it becomes necessary from a study of foreign navies and the water front of approach, to estimate as accurately as may be, the gun strength that may be used in the siege by a fleet, as a basis of calculation of the gun strength to be supplied to the place. At this point the widest divergencies of opinion may be found amongst engineers, and such must of necessity be the case.

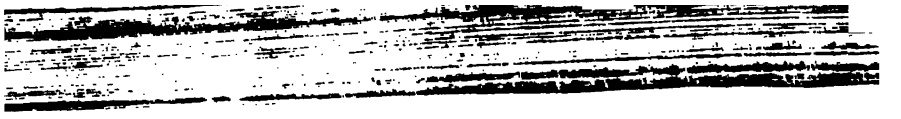
From the intelligent study of past engagements in which fleets and fortifications have figured, the estimates have varied in different times according as the estimation in which fortifications have been held. At one period it was generally thought in this country that the defense is equal to the attack in the ratio of one to two, though it has been contended that it should be one to one. It was a common saying a hundred years ago along the shores of France, that one gun ashore was equal to three or four afloat. Beyond this, every ratio has been advocated up to one to fifty. Of course the natural features of harbors conducing to greater or less ease of defense have an important bearing. Another point of divergence is related to the same question but has to do with the calibers of guns on shore. In this country the practice, so far as known, on which our system is based, is that the guns should be the equal in calibre and power to those to be brought against them, or of power sufficient to master the thickest armor. Such is the general practice, but it is ably and intelligently argued on the other side that there is no need to follow such a system, any more than it is desirable to reproduce on shore the features of battleships in costly armor-faced batteries.

A distinguished American engineer not long since in making a close analysis of coast defenses, in their relation to expense, examined into the best means of investing a limited sum of money for the defense of one position. He rightly concluded that for a million dollars the better investment would be in submarine mines, operating casemates, cable shafts nd galleries, mortar batteries, lifts, and disappearing gun batteries, than in a turret for two 110 ton guns; and that it would be better than the turret and the two guns, to provide the equivalent which would be represented by thirty-two 12″ rifled mortars, six 12″

rifles, one mounted on a lift and five on disappearing carriages behind substantial earth parapets, and an effective system of mines, with casemates, cable galleries, etc.

In pursuance of our present scheme of fortifications, it would seem that following the expressed intention of navies not to mount any longer the heaviest ordnance, the question of the heaviest guns in this country has for the present lapsed, it being understood that no gun heavier than 12″ is contemplated. On the same subject one of the ablest of English writers gives as his opinion that: " A couple of well placed earthn barbette batteries containing a dozen rapid-fire guns might do more for the defense of any given position than the most approved casemated battery or turret mounting 80 or 100 ton guns."

[*To be continued in the next number.*]



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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ORDNANCE AND ARMOR.

(A paper read at the War College in August, 1900.)

By PROFESSOR PHILIP R. ALGER, U. S. Navy.

Ordnance may be conveniently discussed under the four headings of The Gun, Gun Mountings, Powder, Projectiles.

No change has been made for many years in either the material or the general method of manufacture of guns. Larger steel forgings, of higher characteristics, and at lower prices are to be had today than were available a few years ago, but the guns of the Atlanta, Boston and Chicago, designed in 1881 and 1883, do not differ in any essential from those designed two years ago for ships whose construction has just begun.

Progress, as far as the gun itself is concerned, has been in the direction of greater power and greater rapidity of fire. The first of these has come from better powder and larger powder charges, and the second, primarily, from gradual improvements in the details of breech mechanisms—neither has resulted from any radical change of system.

Considering power first. Until two years ago, all our guns were designed with chambers of a size to take a brown powder charge of half the projectile weight, which gave from 2,000 to 2,150 f. s. muzzle velocity, according to the length of the bore, while the use of smokeless powder in the same guns added some 300 f. s. to the velocity, without increase of chamber pressure. It was not inability to increase the power of our guns that held them stationary for so many years. In a paper read here four years ago I stated that the power of any caliber could be indefinitely increased at the cost of the extra weight involved in having a larger chamber to hold a larger powder charge, and

a longer bore to consume it in. It was the disadvantage of the greater weight and cost of the powder charge that made it seem inexpedient to advance in this direction. But the successful development of smokeless powders largely obviated this objection, and an increase of power having been decided on, it was wisely determined to take a long step at once instead of trying to advance by slow degress. The new guns, therefore, were all designed to give 3,000 f. s. muzzle velocity, their smokeless powder charges being of nearly as great weight as were the brown powder charges formerly used by the same calibers; and they have actually given this, and even higher velocities, on the Proving Ground. To appreciate what this means, it must be realized that the muzzle energy of the new guns is two and a quarter times what the old designs of the same caliber developed with brown powder, and from sixty to seventy per cent greater than that given by the old designs when they used smokeless powder.

The new 12-inch gun is as long as the old 13-inch and its muzzle energy is greater, but, with its mounting, it weighs nineteen tons less and its ammunition weighs about 400 lbs. less per round. Supposing an allowance of 100 rounds per gun, we have greater armor penetration and a much flatter trajectory on thirty-seven tons less weight.

The question, then, naturally arises, why not continue further in the same direction? Having replaced a 13-inch gun by a higher powered 12-inch, why not replace the latter by a still higher powered 10-inch gun? We can make a 10-inch gun of as great energy as the latest 12-inch and yet save weight on the total installation. It would require 4,000 f. s. muzzle velocity, but this can be attained, I have no doubt. In fact, we have seen exactly this same line of advance followed in the development of the modern small arm. From the days when the caliber was nearly an inch, till the present time when 6.5 mm. (about ¼ inch) is generally held to be the most advantageous size, progress has consisted in a constant decrease of caliber without any corresponding decrease of chamber volume, the result being a gradual increase of muzzle velocity. The bullet of the 45-caliber weighs four times that of the 6 mm. rifle, but the cartridge case of the latter is almost as large as that of the former, and muzzle velocity has been increased from 1,200 to nearly 2,600 f. s.

There is an important difference between the two cases, however. Flatness of trajectory is equally of value in fighting between ships at sea and between men on shore, on account of the resulting increased danger space. Reduction of weight per round of ammunition, while most important to the soldier, is still of great advantage on the war vessel. But the one disadvantage of the small caliber, its less destructive effect, tells against it in naval warfare far more than in land fighting. Man is so highly organized an animal that, as a rule, any wound will put him out of action, but a ship may be pierced through and through without having either its offensive or defensive powers materially reduced. In a battle, the more men wounded, however slightly, the sooner is victory won; when a great ship is the object of attack, it is most important that each blow successfully landed shall produce a serious destructive effect. The widespread effects of the large caliber shell are needed to produce decisive results. If rapidity of fire were inversely proportional to weight of projectile, the process of reducing caliber could be advantageously extended much further than it now can be, but there is practically little difference between the rates of fire of the 10, 12, and 13-inch calibers, and while a great deal of weight would be saved by substituting a 10-inch gun of equal power for a 13-inch, the decrease of projectile weight from 1,100 to 500 lbs. would not be compensated for by any material increase in the rate of fire, and the slight increase in the percentage of hits resulting from the flatter trajectory of the smaller caliber would by no means make up for the vastly greater destructive effect of the larger shell. In the small-arm and machine-gun field, where it is really better to wound a man than to kill him, and where any man who is hit, whether by a small or by a large bullet, is almost certainly put out of action for the time being, the greater percentage of hits due to the flatter trajectory is important, and the increase in the number of rounds carried by the soldier, due to their less weight, is a decisive reason in favor of the smallest practicable caliber. In the field of heavy naval guns, the destructive effect of each projectile become a matter of great importance, and this consideration puts a limit to advantageous reduction in caliber. For a long time I was an advocate of retaining the 13-inch gun for our battleships. I am now inclined to think that the reduction in caliber to 12-inch is, on

the whole, advantageous, but I think it would be going entirely too far to make the 10-inch the largest naval gun.

Considering next "rapidity of fire." As already stated, so far as the gun itself is concerned, the increased rate of fire from the more recent heavy guns has been brought about entirely by improvements in breech mechanisms. Of course, smokeless powder is the greatest of all the factors that tend to rapid fire under service conditions, and next to this comes skill in rapid pointing, but I refer rather to rapidity of unaimed fire, which depends entirely upon the "loading interval," or the time from one discharge till the gun is again loaded and primed. The automatic principle, whereby a portion of the energy of each fire is used to reload and fire again, has been extended from the machine-gun caliber to the 6 pdr., and even to the 14 pdr., but the 1 pdr., with its 250 shots a minute, seems to be the limit of its really advantageous employment. This system results in a stream of projectiles that can be directed much as is water from a hose, but as the weight and cost of ammunition increase with increase of caliber, it becomes more and more important to make each separate shot an aimed one. Moreover, as the weight of the ammunition increases, automatic loading becomes too violent for safety and efficiency.

The semi-automatic system, in which the force of each discharge opens the breech and at the same time compresses a spring which, when set free by the act of loading the next cartridge, again closes the breech, has a wider range of usefulness. Applied to the 6 pdr., this system has given a rate of fire of upwards of fifty shots a minute, and although of less value as caliber increases, I predict that its use will be extended to the largest guns. The time required to open and then close the breech of a heavy gun fitted with our usual breech mechanism varies from nine or ten seconds for the 8-inch, to upwards of fifteen seconds for the 13-inch, and a saving of this time—possible by utilizing the counter-recoil to open and also to store up power for closing the breech—is of considerable importance.

One of the greatest aids to rapid loading is fixed ammunition, whereby projectile and powder charge are loaded in one motion and no subsequent priming is required; but this becomes impracticable when the weight of a complete round is too great to be readily handled by a single man. This fact limits the advan-

tageous use of metallic cartridge cases to the 5-inch caliber, whose fixed ammunition weighs nearly 100 lbs.

With the 6-inch, and still more with the higher calibers, separate loadings of projectile and powder charge are necessary, and the great weight of the cartridge case makes its use undesirable. It was a mistake to adopt a brass cartridge case for the 6-inch R. F. gun, and with the new 6-inch and even with the new high power 5-inch guns we are going back to the old fashioned cartridge bag. The brass cartridge case had two advantages, even where fixed ammunition could not be used: 1st It was an efficient gas check separate from the breech mechanism itself, and so the latter required no great force to open it and could be rapidly manipulated. 2nd. It carried its own primer and so saved the time required for extracting the fired primer and inserting a new one at every round. On the other hand, the 6-inch case weighed thirty pounds by itself and the extra weight had to be put into and withdrawn from the chamber at each round. A slight improvement in the gas check has now enabled us to use what are called rapid-fire breech mechanisms, which open or close by a single sweep of the hand, on 6-inch, and even larger guns of ordinary type. Moreover, a firing mechanism has been devised that automatically ejects the fired primer as the breech is opened, and that also permits repriming while the breech is open, without any resulting danger of a premature explosion. Thus we are now able, by suppressing the brass cartridge case, not only to make a great saving in the weight and cost of the 6-inch ammunition, but at the same time to slightly increase its rate of fire.

We have never attempted to use a cartridge case with calibers above the 6-inch; nevertheless, the reduction of the loading interval brought about by improvements in their breech mechanisms has been still more considerable than with the 6-inch gun.

With the old 8-inch, at least nine or ten seconds per round were required for opening and closing the breech, and the operation of priming also increased the loading interval; with the latest 8-inch breech mechanism, opening and closing, are much more rapid, and the priming is done while the shell and charge are being located. The result is that a rate of unaimed fire of nearly six rounds a minute has been attained with an 8-inch gun at the Proving ground. When it comes to aimed fire under ser-

vice conditions, of course, such rapidity is out of the question. One well-aimed round a minute would be very good for the 8-inch gun of present service type, and I should say that equal skill might give pretty nearly two rounds a minute with the new gun and also with the most improved electric training gear. Perhaps it would be safer, however, to count on only a round every forty-five seconds.

The latest guns of caliber above the 8-inch will also have a less loading interval than the present ones, due to an important improvement in breech mechanisms, which has been applied to all calibers from the 4-inch up, but which has greater advantages as the caliber increases. I refer to the use of a breech plug that has more than half its surface threaded, thus allowing a decrease in length of screw box, with notable attendant advantages. The method of doing this was devised by Mr. Axel Welin and was acquired by the Bureau of Ordnance from Vickers Sons and Maxim, who controlled the invention. Of course, if three-quarters of the surface of a plug can be threaded instead of one-half, the length can be reduced one-third without loss of strength. The result is that some six or seven inches have been removed from the breech end of the 12-inch gun, which means, first, a saving in weight and cost of gun; secondly, a lighter and more easily manipulated breech block; thirdly, a more direct lead of the ammunition hoists from loading-room to breech, and less space to lead through; and fourthly, a less diameter of turret, with saving of weight and cost of armor. The reduction in the "loading interval," due to this shortening of the screw box, is considerable, and to make any important further gain we must apparently adopt the automatic principle, to the extent of using the force of the discharge to open and afterwards close the breech.

Considerations of weight of breech-block and of space in the turrets will probably prevent the use of single motion breech closures for the larger calibers, and some modification of the automatic system must be relied upon to increase the rate of fire of the 10-inch and 12-inch guns. Furthermore, it must be remembered that the automatic operation of the breech mechanism will result in other important advantages besides the reduction of the loading interval; it will reduce the number of men required for working the guns and it furnishes a perfect

protection against the dangers of hang fires, since the breech cannot open until the powder charge has exploded and caused the gun to recoil.

To sum up, then, in regard to the gun, we have in the last few years increased the power of our guns so that we can now use a 12-inch instead of a 13-inch as the largest gun of our battleships, and we have at the same time increased the danger space of all our guns, so that we are less dependent upon knowledge of distance for accurate gunfire than ever before. We have also increased rapidity of fire by minimizing the loading interval, the gain being great for small guns, and though as yet small for the larger ones, sure of being made greater by the extension to them of the same principles as have been successfully applied to the small guns. It is still true, however, as I said four years ago, that "rapidity of fire with heavy guns depends far more upon the skill to be acquired by constant practice than it does upon further perfection of mechanical details." Nothing but constant practice can give that perfect command of the loading and pointing mechanism, which, far more than anything else, will give rapid and accurate fire.

Coming next to the general subject of gun mountings. The most important recent development in this field has been the successful use of electricity for manipulating the heavy guns. The great advantages of this form of power for use on shipboard are well known—the doing away with the heat and danger of steam pipes, the ease and simplicity of the means of transmission by wire, and the facility of control would long ago have insured the exclusive use of electric power for working heavy guns, had it not been for a general feeling that it was unreliable. Frequent failures of electrical appliances on board ship, and the usual difficulty of quickly locating such failures made people hesitate to rely entirely for electric power for so important a thing as the operation of the main battery of a battleship. But better apparatus, resulting from vastly greater experience on the part of the manufacturers of electrical appliances, better installation, resulting from our own greater experience, and above all, greater knowledge and practical experience on the part of both officers and men, have removed all the serious disadvantages, and in future installation of heavy guns we shall realize the great advantages that flow from the use of electric power. More

accurate, as well as more rapid pointing will be the result, while the danger of hostile fire putting a turret out of action will be greatly lessened. Hand elevation, rendered possible by the use of the gun slide balanced on knife edges, limits the necessity of power, and the use of wires instead of pipes for transmitting the required power, reduces the risk of its being cut off, besides making it much easier to repair a break, if one occurs.

It has taken many years, but at last we have reached the point of ceasing altogether to manufacture gun powder, except for shell charges and saluting, and while large quantities of brown powder are still on hand and must be expended in target practice, all new ships have a full outfit of smokeless powder, and the old ships are gradually being supplied with it. It would be difficult to over-state the importance of this change. Independent of its great advantages from a tactical standpoint, it has added immensely to the power of our guns; it has simplified the loading operations by the absence of the solid residue which resulted from the combustion of gun powder; and it enables us for the first time to really attain under service conditions a rate of fire approaching that which has been reached on the Proving Ground.

Our smokeless powder is a pure colloid produced by the action of ether and alcohol on soluble gun cotton. The Navy owes this smokeless powder to Lt. Bernadou, who with the full cooperation of Capt. Converse, then in command of the Torpedo Station, developed its manufacture from beginning to end. He succeeded in making a gun cotton which we call pyrocellulose, which while containing about 12.4 per cent of nitrogen, is yet wholly soluble, and, when acted upon by ether and alcohol, becomes a very tough and homogeneous colloid which can be relied upon to burn progressively even under very great pressure. One of the troubles with brown powder is that however dense its grain are made, they crumble under high pressure, and instead of burning from the surface and so developing moderate and safe pressures, sometimes go off all at once, as it were, producing sudden and dangerous rises in pressure. To this same action I have always attributed the frequent excessive pressures resulting in several cases in destruction of guns and loss of life to the gun servants, which smokeless powders containing nitroglycerine have given. Excepting where insuffi-

cient experience and care in the manufacture have resulted in the presence of considerable insoluble gun cotton, mixed with the pyrocellulose, we have never to my knowledge, had a case of sudden and excessive rise in pressure, and we have never had an accident, at the Proving Ground, with our smokeless powder. The principle of using a homogeneous colloid, containing no foreign substances whatever, has certainly been justified by results thus far.

As regards projectiles, I can see but one important step in advance that has been taken in this field within the past few years, and that is the adoption of the cap to increase the effectiveness of armor piercing shell against hard faced armor.

The true nature of this valuable improvement is little known and the common explanation of its action is, in my opinion, without any validity or even rational foundation. The vague statement that the cap " supports " the point of the shell explains nothing, and to say that the soft metal of the cap lubricates the shell point and so helps it through the armor seems to me rather absurd. The real explanation of the action of the cap is closely connected with that of the great resistance of the hard face of modern armor. The hard face, being of great strength and of the highest elasticity, prevents the localization of the effect of an impact upon any part of it. Instead of yielding only at the point struck, a large surrounding area comes into play, and, yielding elastically, offers a great and increasing resistance to the impinging object. Now this elastic resistance, much greater than any force produced by impact upon a homogeneous steel plate, is more than the projectile can withstand; the shell yields at its weakest part, and the crushing action, once begun, extends till the whole projectile is smashed into fragments. When the cap is used, the bending back, almost to the point of rupture, of the face of the plate, takes place while the projectile is piercing its cap; the cap is destroyed, but the shell is saved, and when, still intact, it reaches the surface of the armor, it finds that surface on the verge of yielding, and perhaps actually broken through already, just at the point of impact: the projectile is able to penetrate the already weakened hard face and the softer body of the armor is comparatively easy to perforate. There is nothing in this action, as far as its effectiveness is concerned, which at all resembles the action of a buffer. If the cap were a mere

buffer, acting to slow down the shell and so lessen the shock of its impact, we could attain the same result more simply by reducing the initial velocity, but actually a lower velocity of impact seems to add to the certainty of the shell being shattered. One curious fact tends strongly to confirm my theory of the cap's action. If a capped shell be fired against a hard faced plate with very low velocity it is smashed just exactly as an uncapped shell would be. This is because the force of the impact is insufficient to materially weaken the hard face while the cap is being destroyed and so the shell point finds it, not on the verge of yielding, but as strong and resisting as ever. Were the action of the cap a lubricating one, which in itself is inconceivable to me, the fact just set forth would want an explanation.

The manufacture of armor was revolutionized by the discovery that it was practicable to face hardened thick steel plates; the invention of the shell cap has come near to restoring the former relations of armor and projectile. To say that the cap has added 20 per cent to the efficiency of the armor piercing shell is to inadequately represent its value, it has done more than this, it has brought back the old conditions, an increase of thickness of plate can again be met by a merely corresponding increase of striking velocity; whereas with uncapped shell against hard faced armor, a slight increase of thickness of the latter had to be met either by an increase of caliber or by a very great increase of velocity. In my opinion, the cap should be used on all shell, not on armor piercers alone. We have adopted, wisely, I think, the plan of making our common, or explosive shell, of forged steel, having some armor piercing qualities, sacrificing size of explosive charge for the purpose of extending their field of effectiveness to cover the thinly armored portions of an enemy. Such shell would certainly be made still more efficient, if capped, and the cost of capping is so small as to fully warrant its being made universal for shell of 4-inch caliber and above.

We have not yet put loaded A. P. shell into service, but I hope we soon will. It seems to me to be very desirable to use bursting charges of some substance, such as picric acid, jovite, or fined grained smokeless powder, which, by the action of the ordinary percussion fuse, will burst the armor piercing shell. This action is not detonation, but ignition by flame from the

fuse, resulting in a sufficiently slow development of pressure to allow the shell to pass through any armor it can overcome before bursting.

Several years ago we fired at the Proving Ground, a 10-inch A. P. shell loaded with jovite, through a 14-inch Harveyized plate, and burst it behind the plate. The certainty of the shell, if it gets through armor, being broken into pieces, and not remaining whole, would be worth a good deal, even if the explosion itself was of little violence.

As far as high-explosive shell are concerned, we have none in the service, and I see little to warrant their use. To get good effect a high explosive shell requires a fulminate detonator to be associated with it; such shell are vastly more dangerous to use; and, in my opinion, but little, if at all, more effective than powder loaded shell. For use with high angle fire from shore batteries, the high explosive shell of large capacity may serve a useful purpose, since its sphere of action is considerably increased by the torpedo effect of an under-water burst, but in sea fighting, the flat trajectory needful for any reasonable chance of hitting renders such an effect impossible. Recent experience in the Soudan and in South Africa has certainly not tended to uphold the commonly accepted views of the terribly destructive effects of high explosive shell when fired from field and siege guns, and, personally, I believe the reports of the effect of lyddite and melanite shell in English and French tests have been enormously exaggerated. Such shell have not yet been used in actual naval fighting, but I have no confidence in their effectiveness. Even thin armor will cause the detonator to explode the shell harmlessly outside, and a burst inside, while producing a somewhat greater explosive shock and more fragments of the shell, will be less likely to cause fire, and I think, do but little more harm than would the same shell if burst by gunpowder. A design of canister for the 4, 5 and 6-inch guns was adopted some two years ago, and I suppose these projectiles are now being issued to service. While primarily for use against exposed men at short range, they may prove of value in defense against torpedo boat attack, where the chance of a hit from a single projectile from any large gun is very small.

We have, then, four classes of projectiles, A. P. shell for use against armor: common shell for use against unarmored, or very

thinly armored parts: shrapnel for use against exposed bodies of men at a distance: and canister for use against exposed bodies of men at close range.

Which of the first two classes would better be used in a naval action, of course, depends upon the type of our opponents. If unarmored common shell alone should be used, with the proviso, that what we generally called the A. P. shell of the minor caliber R. F. guns are really only steel common shell and should be used even against torpedo boats as the small cast iron shell breaks up on very thin plating. If armored, the question what kind of shell to use becomes more difficult. Considering that either the 10, 12 or 13-inch forged steel common shell will carry their bursting charges through at least 6 inches of hard faced armor, it is seen that by the use of such shell, instead of A. P. shell, we add greatly to the destructive effect of a hit anywhere except on the very small area which is covered by thick armor, while, on the other hand, we reduce to zero the effect of a hit on this thick armor. This seems to me to indicate the desirability of using both classes of shell from the heaviest guns, either firing them alternately, or using the common shell in the earlier part of the action, and later on, when range is shorter, and the enemy's secondary battery has presumably been wholly or partly disabled, using A. P. shell. As for the 4, 5, or 6-inch guns, if we use common shell from them, we restrict their area of destructive effect to the wholly unarmored, and consequently unimportant parts of the enemy, and this seems to me to indicate A. P. shell as best suited to those calibers. If we have 8-inch guns, the thickness of the secondary armor of our opponent must be known in order to decide whether A. P. or common shell are best, if this armor be not over 4 inches thick, common shell will probably get through it and should be used, otherwise A. P. shell. This, however, is all on the supposition that the enemy is of comparatively recent construction, having the distribution of hard faced armor now usual. If of old style, having little or no secondary battery armor, common shell from all but the heaviest guns should be the rule, and, in fact, the guiding principle in all cases should be to use whatever will be most effective against the personnel and the guns of our opponent.

As to a naval attack on shore fortifications I assume that such an attack will only be made under circumstances which

render it essential to destroy, or at least to silence them for a period, and in my opinion there is but one way to do this. That is to put the broadsides of the ships as close as possible to the forts, and from a stationary position, to overwhelm them by superior weight of fire. In a purely naval action, the better your gunnery, the more advantageous it is to you to keep at long range: as distance decreases, superiority depends more and more on number and size of guns, and less and less on marksmanship. (I assume, of course, an equal morale on either side). But the stationary platform, the range finding facilities, and other conditions which obtain in fortifications, are the equivalent of an enormous superiority in marksmanship, and the only way to balance this, is to get so close that every shot from your own guns will hit. If shore guns are mounted so high above the water that they cannot be effectively reached by fire from a ship at short range, then it is practically impossible to destroy them, and nearly as impossible to render them temporarily innocuous. If, however, they can be reached by naval gunfire from short range, then, it seems to me, the quickest, surest, and on the whole the safest way of attacking them, is by going as close as possible, and getting the most out of the ships superior weight of fire. Within 1000 yards, within 500 yards if possible, using common shell from the heavy guns, and shrapnel or canister from some at least of the medium guns, the machine guns in the tops within effective range, it seems to me that a single battleship would more effectually dispose of any given shore battery than would a squadron steaming back and forth at 4,000 or 5,000 yards range. Even if the fort be too high to be commanded by any guns afloat, the breaching of its parapets, necessary for its destruction, can only be accomplished from a position near enough to insure every heavy shell striking, while at the same time the small guns will thus be most effective in keeping down the hostile gunfire. It is in breaching fortifications, if anywhere, that high explosive shell would be of great use, their mining power being two or three times that of black powder shell. In this connection note that there will be great advantage, in any manoeuvering within range of hostile forts, to use as far as possible the method I advocated yesterday for ship actions, *i. e.*, to steer a course such that the bearing of the fort is constant.

The latest armor, said to have 20 per cent more resistance than Harveyed armor, is made by the Krupp process, which, though kept secret, may at least be said to be merely an improvement on the Harvey process. Instead of making the plate of steel containing 3 per cent of nickel, an alloy containing not only nickel, but also a small percentage of chrome, and perhaps also tungsten, is used; the face of the plate is carbonized by some process which is the equivalent of cementation, and finally the usual cold water spray is used to chill the surface. The result is a deeper chill than is ever attained by the Harvey process, and a consequent greater surface resistance, tending to break up shell which strike it. Moreover, there is less cracking under shock or perforation. The improvement, however, is not very great. The so-called increase of 20 per cent in resistance, means resistance to uncapped shell; when capped shell are used the increased resistance to perforation is little or nothing.

As regards the use of armor and its best distribution, it should be recognized that naval victories are far more likely to result from the destruction and demoralization of an opponent's personnel than from actual injury to his ships. The Chinese battleships retreated from the battle of the Yaloo utterly defeated, yet neither their stability, their machinery, nor their offensive powers had been seriously affected; at Manila Bay, and again at Santiago our gunfire did not injure the Spanish ships so much as it did their crews, and except for the fires which an inefficient and demoralized personnel could not control, the material would have remained practically uninjured. Armor, in fact, was devised as a means of protecting the personnel from the effects of shell fire, and in so far as this end has been lost sight of, and attention directed mainly to the protection of the water line and motive power, an error has been made. The present tendency to thin water line armor and devote the greater part of available weight to protecting the guns and their crews, seems to me to be a wise return to first principles. It is useless to endeavor to secure complete protection for anything; the heaviest guns of a battleship will drive their armor piercing shell through any armor yet made or ever likely to be made if they hit nearly normal. The most that can be asked of armor is that it shall protect whatever is behind it from anything but the direct hit of a large caliber projectile. The Maine class have a belt tapering from 11

to 7½ inches, a great change from the belt of the Indiana, the 14-inch belt of the Iowa, and the 16½ to 9½-inch belts of the Alabama class. Yet I think even a further reduction, if made for the purpose of adding to gun protection might be defended. What is wanted is to entirely exclude any explosive shell of sufficient power to pierce the protective deck with its fragments; to keep out all projectiles except those of the largest caliber striking nearly normal; and to sufficiently retard the latter to prevent them from getting through the protective deck. The chance of hitting the belt is very small; only about ⅙ as great as that of hitting a 12-inch emplacement (turret and barbette), and the chance of a normal hit on the belt is almost nil. At Santiago there were but three hits on the belts of the Spanish ships, out of 9,500 shot fired, and in the Belleisle experiment, where the vertical errors were much less than they would be in action, and where double the usual width of belt was exposed owing to light draft, there were, so far as I have been able to learn, only about 15 hits on the belt out of over 1300 shot fired. Consequently, I think the Maine's 9½-inch at the water line, with water excluding material behind it, and with a protective deck 4 inches thick on the slope, furnishes ample protection. The following are the approximate armor weights ot the Maine class:

Belt	785 tons
12-inch gun protection	845
Casemate	795
Conning and signal towers	90
*Protective Deck	1039
	3554

From which it will be seen that after more than half the available weight has been devoted to the protection of buoyancy, stability, and motive power, the remainder is approximately halved between the 4 12-inch and the 16 6-inch guns.

As regards the two heavy guns' emplacements, the 12-inch armor seems to me to afford reasonable protection except in

* This is total weight of deck. The armor plating on the deck only weighs about 550 tons.

one respect. I think the port plates of the turrets, which are always towards the enemy, and which are weakened by the port holes, need further strengthening. It is customary to make these plates slightly thicker than the others in the turret, and in the case of the Maine class, while the rest of the turret armor is 11 inches the port plate is 12 inches thick. Moreover, in our present excellent turret design, the port plate is sloping so that the angle of impact cannot be much less than 35° in any case. Still, considering that the port of the turret must always be exposed to direct fire, while the rest can only be hit from the unengaged side, and considering further that but little extra weight would be needed, I cannot but think that the port plates should be made much thicker than is the present practice. Especially should this be done in the case of the 8-inch turrets on ships carrying them. The plans under consideration for the Pennsylvania class contemplate about the same belt and 12-inch turret armor, and also provide 6-inch turret armor with 6½-inch port plates for the 8-inch guns. It would add practically nothing to their total armor weight, and would, in my opinion, greatly increase their defensive power if the 8-inch turret port plates were made 10½ inches thick instead of 6½ inches.

As regards the 795 tons of armor given to the protection of the 6-inch guns of the Maine class, it is to be noted that about half of this is used to cover the space between the top of the belt and the deck upon which the 6-inch guns are mounted. This is to prevent the alleged great destructive effect upon the deck of high explosive shell if allowed to freely enter the space beneath it. It seems to me that some better arrangement could be made than to cover with armor an immense space which contains practically nothing of importance. The smokestacks, 6-inch ammunition hoists and anything else worth protecting could be directly armored for a small fraction of the weight now used in covering the whole side, and I would advocate an entirely different arrangement. I have become convinced of the necessity of more complete isolation for guns than we have thus far ever given them. The effect of a single heavy shell bursting in the casemate, might well be to put out of action every gun it contains. I used to think that traverses were sufficient protection against this, and that the advantages of a comparatively open battery deck with free communication from gun to gun were

too great to be given up. Smokeless powder renders central battery control much less important than formerly, individual firing must practically be used under all circumstances of action and, furthermore, we have had recent practical lessons as to the widespread destruction that may be caused by the explosion of one large shell. If all the guns are in pairs in turrets, each with enough armor to give it safety unless directly hit by a heavy gun, then no shell can do more than put one pair of guns out of action, and, what I think is of great importance, not only is material damage localized, but so equally is moral effect—each turret will go on fighting, independent of and even quite ignorant of the destruction which may have visited the others. In the Pennsylvania class it is now proposed to expend 1100 tons of armor in covering a space about 250 feet long by 15 feet high in order to give 12 6-inch guns 6-inch armor protection. The turret system would give much better protection on much less weight, and at the same time greatly reduce the area which must be hit in order to disable a gun. One objection will be the fear that rapidity of fire will be reduced by mounting the guns in pairs in turrets instead of in separate broadside ports, but with the facility of train given by the use of electric motors, I do not think that there will be any marked difference in this respect. It must be remembered that in future the 6-inch brass cartridge case will be dispensed with, so that there will be no more trouble in disposing of fired cases, a difficulty that might be serious in a turret. The shell could be stored, at least to a considerable number, in the turret itself, and there would be at least as rapid a supply of ammunition as if the guns were mounted on an open deck. If, however, the turret system is not used for the 6-inch guns, then certainly these guns should be better protected than they have been hitherto from the effects of a large shell bursting within the battery; heavy transverse bulkheads between the guns, will furnish very important protection, but longitudinal bulkheads behind the guns should also be used, so as to have each gun in a compartment by itself. More certain destruction of the entire contents of any department entered by a heavy shell will result, but so also will such destruction, with accompanying flames, smoke fumes, and the demoralization effect of the sight of killed and wounded, be equally localized. There is this to be said, casemate armor, like belt armor, can only receive a

normal impact when the ship is at exactly right angles to the line of fire of an enemy, while turret armor is always exposed to the possibility of a normal hit; but, on the other hand, the use of turrets instead of a casemate, greatly reduces the target area. With the casemate what is most to be feared is a raking fire, a heavy shell entering and ranging force and aft, and this is one more objection to the end on position to an enemy.

The foregoing discussion naturally leads to the question of the caliber and arrangement of guns best suited to a battleship. There is almost universal agreement as to the great advantages of two pairs of heavy guns in turrets on the center line, one forward and one aft, but what the remainder of the battery would better be is much more doubtful. Were it practicable to mount a third pair of heavy guns on the centre line, I would greatly prefer doing so and sacrificing all other guns excepting small R. F. guns for use against torpedo boat attack. Assuming, however, that this cannot well be done, the question seems to narrow itself to this,—shall we have 6-inch guns alone, 6-inch and 8-inch guns, or shall we adopt an intermediate caliber, say the 7-inch?

In modern battleship design weight of battery counts for little as compared with space for good gun positions. If the 5-inch R. F. gun could pierce any secondary armor, we still could not afford to have 5-inch guns only as a secondary battery, because good positions cannot be found for enough of them. We would still use 6-inch guns because we can mount as many 6-inch as 5-inch, and while an equal weight of 6-inch guns would give less, and an equal number of 6-inch guns would give much the greater volume of effective fire. Now this argument seems to lead logically to the use of a still larger caliber, say the 7-inch, instead of the 6-inch, but the objection to this is that when you go beyond the 100 pound 6-inch shell two men are required to handle the heavier projectile and at once rapidity of fire is greatly reduced. Granting that the 6-inch gun is effective against all secondary armor, I think it must be admitted that this caliber is the proper one for the secondary battery of a battle ship.

The question, then, is, shall we have any other guns, of caliber between the 6-inch and the 12-inch, and to this I answer yes for the reason that there is an ideal gun position on top of the 12-inch turrets, and since we can only mount one pair of

guns in each of these positions, we must chose the most effective ones. 6-inch guns equal in weight to 4 8-inch may give a greater volume of effective fire, but if forced to chose between 4 6-inch and 4 8-inch, the latter seems to me much the preferable. While it is true the weight of fire per minute of a 6-inch may equal that of an 8-inch gun, the much greater certainty of the 8-inch piercing the armor of an opponent adds enormously to its value.

To sum up then, I would advocate, 2 12-inch turrets with 8-inch turrets on them, and a 6-inch R. F. battery between the heavy gun positions. I should prefer the 6-inch to be in turrets, three pairs on each side on the main deck, and a pair on each side on the upper deck, but if in a casemate, I think that each gun should be completely enclosed. As to the superimposed turrets, their advantages are so great as to demand their use even should the 8-inch caliber be abandoned. 6-inch in turrets must then be placed on the 12-inch.

Every one must recognize the great tactical advantages of putting an 8-inch turret on the middle line instead of on the broadside, and the only practicable way of doing this is by the use of the superimposed turret. There have never been but two objections, worthy of consideration, to this plan. The first, that there would be interference between the two pairs of guns, the loading and firing of one pair disturbing that of the other pair, seems to have been disposed of by the tests of the Kearsarge. The second, that there is too much concentrative of the battery, too many of your eggs are put in one basket, is still open to argument.

That an 8-inch turret on top of a 12-inch turret is very much safer than one standing by itself seems to me unquestionable; the turrets themselves have exactly the same chance of being hit, but the loading and training apparatus of one is protected by the thick armor of the 12-inch turret and barbette, while that of the other has only the protection of its own thin barbette armor. If, moreover, the weight of the 8-inch barbette, which is saved by the superimposed turret plan, be used to double the thickness of the 8-inch turret armor, then evidently, on equal total weight we have much greater safety from injury as well as the double offensive power given by the middle line position. The only answer to this is the statement that a shell which enters the

superimposed 8-inch turret and puts its guns out of action, may also disable the 12-inch guns, but, in my opinion, this is a very improbable occcurrence; a burst in the upper turret may drive some fragments down through the loading openings and do some harm in the lower turret, but no serious harm, the heavy plating between the two turrets will prevent that. The only weakness of the double turret is the fact that an injury to the 12-inch training gear will affect a pair of 8-inch as well as a pair of 12-inch guns, to balance which we have the fact that there is only one barbette to be hit, instead of two, and that one having thick armor. Therefore, certainly, the advantages are altogether on the side of the superimposed turret, and I think that few, if any, of its opponents, but would prefer this to the broadside position if only two 8-inch turrets were in question. Whatever strength their argument has lies in the contention that four turrets, two on each broadside, are better than two superimposed turrets. Now, personally, I deny this. I contend that the multiplication of gun positions, with an equal increase of the vulnerable area, is of little or no value, unless there be an accompanying increase in volume of fire. The two superimposed 8-inch turrets give the same weight of fire against a single opponent as the four broadside turrets, and the chance of being engaged on both sides at once is too remote for serious consideration. At the same time the four broadside turrets offer twice the target area of the two superimposed turrets. But without regard to this, if it once be admitted that two superimposed turrets are better than two turrets, one on each broadside, then, in case four are proposed, why not have two of these superimposed, and at least gain that much? I cannot but think that the continued opposition to the superimposed turrets is due to an excess of that valuable quality, conservatism. Certainly, to delay decision for the sake of a practical demonstration of the advantages of the system, is useless, for no such demonstration is possible. Actual tests can, and I believe have, shown that there is no interference of one turret with the other tending to slow its fire or reduce its accuracy, but what more they are expected to show, I cannot imagine. No practical tests, not even the test of actual battle, can do anything towards settling such a question as this. The victory of one battleship over another could hardly be claimed to be the result of a superior arrangement of battery,

too many other possible causes may have existed to allow such a conclusion to be undisputed. After all, the lessons of any future naval combat are only the conditions drawn by reasoning from certain facts or alleged facts and are just as open to dispute, just as likely to be denied, as are the conclusions drawn from the vast storehouse of past experiences.

Take the question of the use of shields for small guns. They have many advocates and many opponents. In recent battles we have seen several examples of the disastrous effects produced when they are struck by a heavy shell. But has this demonstrated anything, has it convinced their advocates that they are wrong? Not at all. I have always opposed the use of such shells, but I recognize that no new light has been thrown on the subject. Because in several instances whole gun's crews have been swept away by the bursting of a shell, otherwise harmless, against a shield, it does not follow that such shields may not, in the long run, save still greater numbers from being killed by small projectiles. If we wait for a so called "practical demonstration" of the advantages of every proposed change in naval construction, we shall always be in the rear. Who, giving thought to the matter, could have been ignorant of the danger which would arise in action from the use of great quantities of wood in warships—one of the first acts of Admiral Sampson, when he became Chief of the Bureau of Ordnance, was to call the Department's attention to this and urge a reform—yet we waited for the practical demonstration given by the battle of the Yaloo before we took any steps to remedy our mistake. The great improvement in the physical qualities of steel produced by the addition of a small percentage of nickel, and the successful manufacture of great quantities of nickel steel for armor, were sufficient proof that this material would be of great value in naval construction and in marine engineering, but when its use was urged the demand for a "practical demonstration" of its advantages carried the day, and though the first to benefit by the adoption of nickel steel for armor, we are likely to be the last to obtain the even greater benefits of its larger use.

If we wish to be in the van of progress we must act upon well considered conclusions drawn from past experiences, trusting that the future will confirm our judgment. If we refuse to accept any change until its advantages have been fully demonstrated by actual experience we must always be behind the times.

POSTSCRIPT BY THE AUTHOR.—When this article was written, nearly two years ago, it seemed likely that the new 6-inch guns, then just designed, would be a match for any secondary armor likely to be used on battle ships. The increase of such armor to 7-inch thickness in recent foreign designs, renders it essential that we shall abandon the 6-inch caliber for our battle ships, and the great question to-day is whether we shall substitute for it a 7-inch gun or an 8-inch gun. If we adopt the 7-inch, we can mount that caliber on broadside, but if we use the 8-inch guns, we must mount them in pairs in turrets. Personally I favor the latter plan, but it seems to me that the time is now ripe for careful consideration of the question whether we should not now abandon all guns of caliber between the 12-inch and the 3-inch, and revert to the old idea of having the fighting force of a battle ship consist entirely of heavy guns behind thick armor. When it is considered that only the unessential parts of a modern battle ship can be successfully attacked by any gun less than 8 inches in caliber, and that the abandonment of the intermediate guns and the armor placed for their protection would save enough weight to enable us to make all vital parts invulnerable as against anything below the 12-inch caliber, it becomes exceedingly doubtful whether we are acting wisely in exposing ourselves to defeat through demoralization by the destruction of auxiliary guns and their crews. About 2320 tons is the weight of the 6-inch and 8-inch guns, mounts, and ammunition, together with the armor defending them, on the Pennsylvania class, and, excepting to some extent the 8-inch guns, the only function of this immense battery is to attack the unessential parts of an opposing battle ship,—sweep it all away, and, excepting for the loss of life involved, your ship, so far as her power of destroying her opponent goes, is as powerful as ever. Why not, then, make our battle ships invulnerable to guns of moderate size, and arm them only with guns each hit from which means a real and possibly a fatal injury to an opponent. At least let us not put anything smaller than an 8-inch gun on any battle ship, excepting, of course, such small guns as are needed for torpedo defense.

P. R. A.

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MODERN ARMOR; ITS INFLUENCE ON THE DEVELOPMENT OF ORDNANCE.

By LIEUTENANT CLELAND DAVIS, U. S. Navy.

In an article published in the Naval Institute in 1897, the writer endeavored to briefly summarize the theory of resistance of face hardened armor, of the action of the projectile upon impact, and the effect of the cap.

Since that time the development of armor has been along the same lines, and the deductions therein given are applicable to present conditions. This theory is based upon the elastic property of the highly tempered supercarbonized face. When the point of the projectile reaches the face of the plate, the latter is elastically depressed or dished over a considerable area. The strain of impact is thus transmitted to the tough back, bringing to bear all the resisting power of that portion of the plate in wake of the dished surface to check the velocity of the projectile. When the limit of elasticity is reached, the hard face begins to give way, cracking along radial lines emanating from the point of impact and breaking off towards the circumference of the dish, causing the flaking or spalling characteristic of hard faced armor, and the subsequent operation is one of displacement of the molecules of the body of the plate by punching or boring of the shell. It must be remembered that the hard face is intact until the moment when the maximum depression is reached. The work done in dishing the plate reacts on the projectile, and if the latter has not sufficient remaining energy to absorb this reaction it must of necessity break up. A 5-inch uncapped projectile at 1800 f. s. striking velocity will not mar the surface of a 5-inch Krupp or Harvey plate. At 1825 f. s. there will be

an appreciable penetration. Thus it will be seen that the plate has absorbed 1123 foot tons of energy of the projectile before the latter begins to do work in displacing the molecules of the plate.

This may be called the critical point of resistance, and measures the advantage of hard faced armor over homogeneous steel. The amount of energy thus absorbed reaches a maximum when the energy of the projectile is just sufficient not to break in the hard face. Below that point no projectile has ever been known to rebound unbroken. As the velocity increases the area of dished surface decreases, due to the time element; the amount of the energy of impact absorbed before the projectile begins to enter becomes less, and the ratio between this energy and the total energy of the projectile constantly decreases.

Action of the projectile.—It seems to be the generally accepted theory, and one upon which the design of shell is based that the projectile breaks up progressively from the point. A great number of observations has led the writer to believe that this is never the case with good projectiles. In the first place the point is the best part of the shell and the strongest, and in the design of shell universally used, is in such a position that on impact less strain comes upon it than upon any other portion of the shell except the apex of the powder cavity and the extreme base. An examination of the section of a shell will show this to be a fact.

First it must be remembered that the projectile breaks up by being stopped in a comparatively short space, rupture occurring through the inertia of its own mass. Now, so far as the capacity of the projectile for doing work is concerned, its energy may be assumed to be concentrated at the point, but when the energy reacts upon the shell itself, due to its retardation, the force is concentrated along lines which are the elements of a cylindrical surface, the radius of which is equal to the radius of gyration referred to the axis of the shell. The effect is first an upsetting in the region of the bourrelet, then rupture along longitudinal lines forming ribbon-like strips evenly distributed around the circumference, and finally along transverse lines at the weakest points. When the energy of the projectile is sufficient to effect an entrance through the hard face, but when only partial penetration occurs, the heat softens the hard metal on the surface of

the ogival, a portion of the head mushrooms into the indent, and the previously disrupted pieces of the bourrelet and base mash on top, giving the appearance of shearing at an angle of 45 degress from the apex of the powder cavity.

Many theories have been advanced as to the effect of the cap. Some hold that it acts as a lubricant or sleeve to smooth the passage of the projectile through the hard surface and the body of the plate. Others believe that it acts as a support for the point, and still others hold that it distributes the strain of impact over a considerable area of the surface of the ogival; these being based on the theory that the projectile crushes progressively from the point. These and other theories which have been advanced, such as the cap acts as a buffer for the projectile, are founded on the assumption that the cap is a direct aid to the projectile. The truth is that the function of the cap is to prepare the plate so that the projectile strikes it at the most advantageous moment. The cap must of necessity be destroyed before the point begins to enter the plate, being drawn out or attenuated far beyond its elastic limit as the shell passes through it, and in reality operates to slightly reduce the velocity of the projectile before the latter touches the plate. The true theory is believed to be as follows: When the mass, consisting of the cap and projectile, strikes the plate, the latter is dished elastically as before described, absorbing a considerable proportion of the energy of impact. This energy does not, however, react on the projectile, as in the case before described, for the velocity of the projectile is barely checked, its progress through the cap being comparatively easy, so that it reaches the plate with nearly all its original inertia and finds the latter already dished to its elastic limit, so that the resistance becomes purely local, the hole gradually enlarging as the projectile advances. This explains the much smaller area of flaking on impact of capped projectiles. An analogy may be found in the action of a thin sheet of ice on a pond. Toss a weight on the ice and it will crack in all directions from the point of impact before breaking through. Put a slight pressure in the vicinity of the point where the weight falls and it will break through with hardly any cracking at all.

Up to the critical point of resistance the cap has no effect whatever on the plate. Beyond that point it reduces the efficiency of hard faced armor so that the latter is little better than homogeneous steel in resisting qualities.

In the present state of the art the manufacturers are unable to regulate the depth of carbonization and chill. Consequently the hard face is of the same thickness for all thicknesses of plate.

After the hard face is broken in, perforation occurs by boring or punching of the projectile, so that the effort should be to get a plate that would offer the greatest resistance to these effects. The theoretically perfect plate then would be of hard steel uniformly tempered throughout and tough enough to resist cracking. But this is impossible of attainment. So that the compromise after which the armor makers are striving is a plate with a maximum thickness of hard face combined with a minimum thickness of tough back that will bind the hard surface and prevent the whole from cracking

Now, the superiority of Krupp armor over the Harvey is mainly due to the composition of the steel used in the former, and this makes the plate more amenable to treatment, giving a tougher body and thereby making the plate less liable to crack, and at the same time increasing the depth of chill. This latter is by far the more important. Against uncapped projectiles there is a gain of from 15 to 20 per cent in resisting power. Against capped projectiles the effect of the hard face is practically nullified and hence the resisting power of Krupp and Harvey plates is about the same, the former having a slight advantage due to the fact that the projectile, after entering, has to pass through a greater depth of very hard steel, the molecules of which offer a greater resistance to displacement than those of the comparatively soft metal below the surface.

Following is a table showing the perforation of Harvey and Krupp armor by capped and uncapped projectiles from the latest types of naval guns with service velocities:

The perforations therein given for Harvey armor were calculated from formulae worked out by the writer in 1897, and agree closely with results since obtained. Strange to say, the formula for capped projectiles applies equally as well to Krupp as to Harvey armor, except for a very slight advantage in favor of the former for intermediate thicknesses of plates.

These formulae are:

Projectiles without caps. Capped projectiles.

$$V = \frac{a^{\frac{1}{2}}\, e^{\frac{3}{2}}}{p^{\frac{1}{2}}} K, \qquad V = \frac{a^{\frac{1}{2}}\, e^{\frac{3}{2}}}{p^{\frac{1}{2}}} K'.$$

TABLE OF ELEMENTS OF LATEST TYPES OF NAVAL GUNS (MODELS OF 1899). GIVING PERFORATION OF FACE-HARDENED ARMOR, SERVICE VELOCITIES, AT RANGES UP TO 3000 YARDS, WITH SMOKELESS POWDER. CAPPED AND UNCAPPED ARMOR-PIERCING PROJECTILES, AT NORMAL IMPACT.

Caliber of gun.	Weight in tons.	Length in caliber.	Total length in inches.	Approx. charge of smokeless powder for maximum vel. lbs.	Weight of projectile lbs.	Muzzle velocity. f. s.	Muzzle energy. ft. tons.	Perforation at muzzle.				Remaining velocity at 1000 yds.	Perforation at 1000 yds.				Remaining velocity at 2000 yds.	Perforation at 2,000 yds.				Remaining velocity at 3000 yds.	Perforation at 3000 yds.			
								Harvey nickel-steel.		Krupp armor.			Harvey nickel-steel.		Krupp armor.			Harvey nickel-steel.		Krupp armor.			Harvey nickel-steel.		Krupp armor.	
								Capped projectiles.	Uncapped projectiles.	Capped projectiles.	Uncapped projectiles.		Capped projectiles.	Uncapped projectiles.	Capped projectiles.	Uncapped projectiles.		Capped projectiles.	Uncapped projectiles.	Capped projectiles.	Uncapped projectiles.		Capped projectiles.	Uncapped projectiles.	Capped projectiles.	Uncapped projectiles.
3-inch Mark I.	.87	50	154.3	5	13	2800	709	4.4	3.6	4.4	3.6	2130	3.1		3.1		1620									
4-inch Mark VII	2.56	50	204.5	15	32	2900	1870	6.7	5.7	6.4	5.6	2380	5.3	4.4	5.2	4.4	1955	4.	3.4	4.	3.4	1605	3.2		3.2	
5-inch Mark V	3.3	50	255.	27	60	2900	3503	8.6	7.5	8.4	6.6	2460	7.	6.	6.7	5.6	2085	5.7	4.7	5.5	4.7	1770	4.6	3.9	4.6	3.6
6-inch Mark VI	8.37	50	300.	46	100	2900	5838	10.9	9.3	10.9	7.3	2525	8.9	7.7	8.8	6.8	2185	7.4	6.4	7.2	6.	1805	6.2	5.3	5.9	5.2
7-inch Mark I	13.33	45	315.	74	165	2900	9646	13.2	11.8	13.2	10.5	2580	11.4	10.1	11.4	8.9	2295	9.8	8.6	9.7	7.6	2040	8.5	7.4	8.3	6.5
8-inch Mark V	18.	45	343.	115	250	2800	13602	15.0	13.6	15.	12.1	2530	13.2	11.8	13.2	10.4	2090	11.7	10.4	11.7	9.1	2070	10.3	9.	10.3	7.9
10-inch Mark III	33.4	40	400.	240	500	2800	27204	20.	18.6	20.	17.1	2585	18.3	16.7	18.3	15.	2390	16.5	15.	16.5	13.5	2210	15.	13.	15.	11.5
12-inch Mark III	52.	40	493.	385	850	2800	46246	25.	23.4	25.	21.7	2620	23.	21.4	23.	19.4	2450	21.2	19.6	21.2	17.9	2295	19.5	17.9	19.5	16.2

Where V = Striking velocity in foot-seconds
a = Caliber of gun in inches
e = Thickness of plate in inches
p = Weight of projectile in pounds
log K = 3.34512
log K′ = 3.25312

It must be remembered that the thickness of armor given just matches the velocity, so that it may be assumed that the projectile is just defeated, that is to say, under normal conditions of plate and projectile, the latter would be broken up and lodge in the backing, and so fail of its purpose of getting through the armor and exploding inside the vessel. In other words, armor of those thicknesses offers a sufficient protection against the corresponding guns. To insure complete perforation, the projectile passing through and remaining intact, from 100 to 200 f. s. should be added to the velocities given.

There are but meager data as to the effect of the very high velocities. It is believed, however, that for these high velocities the thicknesses given are in favor of the armor. As the velocity increases the energy increases as the square of the velocity, there is less strain on the projectile, and the resisting power of the plate decreases due to the fact that the time element limits the area of distribution of resistance. The perforating power therefore varies as the (1 plus x) power of the velocity.

The function of armor is, first to prevent holes being made at or immediately below the water-line, and in this function it is assisted by the construction of the vessel and by the use of water excluding material. Second, to protect the machinery and the guns of the vessel. Third, to protect the personnel. This last is held by a great many officers to be the most important of all and the writer, too, is inclined to this view, having due regard for the importance of the others.

The most formidable feature of the gun is admittedly its ability to throw a shell charged with an explosive at sufficient velocity and of sufficient strength to perforate armor and backing intact and explode on the inside of the vessel. All other methods of attack at or above the water line can readily be defeated by the armor now being placed on battleships, except solid shot, which is now being abandoned by all services.

The use of high explosives against the outside of the armor has many advocates. But all experience goes to show that the only result is the cracking of the plate, and this is what would be expected from a careful consideration of the action of the force generated. Detonation is produced by wave action within the mass, and the result is a gas which, on expanding in the attempt of the molecules to assume normal relations with respect to one another, is capable of doing work. The direction of this expansion can sometimes be controlled by what is known as tamping, and the force of expansion concentrated in a definite line, but even then the force decreases in power with tremendous rapidity. Now, assuming that the high explosive is fired from a powder gun, which seems to be the only practicable method of projecting it, means must be provided for properly containing the charge, and for detonating it at the right moment so that the force generated will act in the right direction. All this is extremely difficult of accomplishment, if not impossible. If successfully accomplished, there remains the effect of the explosion on the plate. We have on the one hand the great mass of metal in the plate, the molecules of which are extremely tenacious, and on the other, a column of gas the molecules of which are moving individually at the rate of 20,000 feet a second. This column strikes the plate with a sudden blow and thus transmits a considerable shock that may be sufficient to crack or rupture it along its weakest lines. But this column of gas is not a coherent mass, and as a mass possesses little or no inertia, and, when the molecules at the head of the column strike, having no tenacity, so to speak, and so being unable to displace the molecules of the steel by shearing or punching, they must of necessity react upon the molecules of gas in the rear or spread out laterally;—and thus is the force expended, constantly decreasing until the whole is dissipated. And the time consumed in the whole operation is so small that I believe that the heaviest charge it is practicable to explode against a large plate would be barely sufficient to overcome its inertia, so that there would be little or no strain transmitted to the structure behind armor. In the case of thin plating, in the bottom of a vessel, the first shock is sufficient to tear a hole in the plate, thus opening a way for the gases behind to pass through and do their work.

The foregoing remarks suggest the probable lines of development of armor and ordnance in the immediate future. First as to armor. It must be remembered that the primary function of armor is to prevent explosive shell from passing through it and exploding in the interior of the vessel. This is being recognized, as is shown by the tendency to decrease the thickness of armor classified as hull protection, and increase the thickness of that for gun protection. In a very short time I expect to see our battleships with casemate armor eight or nine inches thick.

Now the most efficient armor for preventing projectiles from passing through it intact will be made of steel that offers a maximum resistance to shearing of its particles, that is, to boring or punching. For this purpose it should be very hard, perhaps not all the way through for that is now impracticable, but at least to a considerable depth below the surface, even at a sacrifice of toughness with the consequent liability to crack.

Strange to say, while armor has been developed so as to increase its efficiency in a remarkable degree, the projectile of today is of the same design and but little improved in quality over that of ten years ago, before the advent of face-hardened plates.

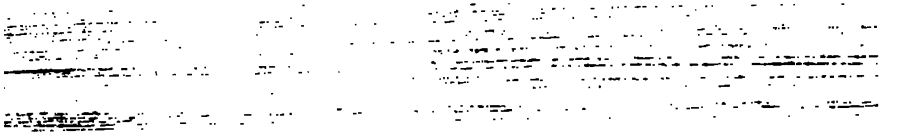
With the idea of increasing the strength and at the same time preserving and even increasing the capacity of the powder cavity, the writer has designed a new form of shell which it is hoped will give increased perforating power and at the same time be well conditioned for bursting effect. The cap will be retained, for it is the simplest, and at the same time probably the most effective device ever developed in the history of ordnance. The object of a bursting charge in a shell is primarily to burst the shell, and it is the fragments of the latter that do the damage. It is possible that the flame of the charge may set fire to light inflammable substances with which it might come in contact, but fire is almost invariably produced by heated fragments of the shell.

The use of high explosives in shell is only of value in that the shell may be made stronger by decreasing the size of the cavity, thus giving greater perforating power. But a detonating explosive is so difficult to control that an explosive of the second order would seem more desirable as a bursting charge for shell, even at some slight sacrifice of strength of the latter.

The development of the armor piercing shell contemplates a shell that can be sent through face-hardened armor, a caliber in thickness, at 3000 yards, with service muzzle velocities, and exploded beyond, and this is in process of accomplishment.

The tendency is towards the adoption, for the main and auxiliary batteries of battleships, of capped armor piercing shell only, fuzed and loaded with smokeless powder, and, for cruisers, a proportion of these with cast or forged steel shell, fused and loaded with black powder and capable of piercing intact armor one half a caliber in thickness.

The value of high velocity cannot be overestimated, especially with respect to the perforating power of the projectile. It would seem that the limit of velocity has been nearly if not quite reached with the present design of gun. The conditions of mounting on board ship limit the size and length of each caliber. The ideal gun is of course a thick cylinder with the curve of the powder pressure a straight line parallel to the axis of the bore. But up to the present time no powder has been developed that will even approach these conditions. Having settled upon a colloid powder, further development should be in the direction of the form of charge. There are a great many objections from a theoretical ballistic standpoint to the present form of grain. It would hardly be pertinent to discuss these here; but it must be remembered that when smokeless or colloid powders came into use, guns were of a settled type, and the powder had to be made to fit the gun. The writer is of the opinion that we should endeavor to get a powder having the best theoretical ballistic qualities and then design the gun to fit the powder. This would seem to be not impossible of accomplishment and the prediction is ventured that 4000 f. s. will be the service muzzle velocity at no very distant date.



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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NAVAL RECONNAISSANCE IN TIME OF PEACE.

By LIEUTENANT JOHN M. ELLICOTT, U. S. N.

When war threatens with a maritime power, our navy will be called upon to prepare a plan of campaign. To do this it is not sufficient to know the numerical strength of our opponent's navy, the distribution of his forces and the characteristics of his warships; but we should also know the strategic value of all his ports, harbors and naval bases, and their tactical strength, weakness and resources. We should know the same of all such places belonging to any neighboring country to our opponent or to his outlying possessions, and of all such places lying between us and him; and we should know the same of our own ports and harbors. This knowledge cannot be acquired after war threatens or breaks out; there will be neither time nor opportunity. The barest common sense dictates that it must be obtained, if at all, in time of peace; and a little prudent foresight suggests that it should not alone be obtained, but classified, filed and kept up to date in the most persistent, painstaking and methodical way, so that it shall be but a matter of a minute to lay the Government hand upon any portion needed.

We have had in the aggregate, more than a hundred years unmarked by war, during which our naval vessels have visited nearly every port in the world, and have lain in them weeks and sometimes months at a time. Throughout such periods our officers, educated to the highest pitch of professional mental attainment, have spent much of their time keeping their ships scrubbed and swept, and having bells struck to mark accurately the hours thus intellectually wasted. Their very limited periods of time allowed on shore are naturally and almost necessarily

spent in recreating for further arduous misapplication of professional ability on board. There is scarcely an instance in our aggregate hundred and odd years of peace, of an officer being given the opportunity and the instructions to put his specially trained intelligence to work to study the feasibility of capturing or defending the ports visited, and to learn their strategic value in probably maritime wars; yet such study is one of the first natural and essential preparations for war, and it is for war that the officer is trained and the ships are built. There is, to be sure, nowadays, and has been for some few years, an intelligence officer, detailed from among the ship's complement, who is directed to gather information concerning foreign men-of-war, arsenals and dockyards when he falls in with them, and, incidentally, some general information concerning ports. This, however, he must usually do in addition to his other duties, or be regarded with suspicion by his captain and messmates as shirking a watch if he asks for special opportunities. Even when he succeeds in finding time to do his intelligence work, he is furnished with neither outfit nor adequate funds, and his instructions are seldom more than to seek details of armaments and mechanical equipment. These are, of course, important, but even if we learn such details concerning a fortified port, they are of little use to us without that knowledge of its environment which will enable us to make plans for its capture. Such knowledge can only be acquired by reconnaissance.

Reconnaissance may be defined as the process of obtaining information for war purposes. If made in the presence of the enemy it is termed *tactical reconnaissance* or, when conducted in spite of opposition, *reconnaissance in force*. It is not of these that this paper will treat, but of the wider branch of *preliminary reconnaissance*.

All military students and writers agree that the marvelous success of the Prussian army, in 1870, was largely due to the thoroughness of preliminary reconnaissance made during the years of peace following the downfall of Napoleon I. The magnificent demonstration given in 1870, of the decisive results of such work, has led the German and other governments to perfect it as a branch of war preparation. Derricagaix tells us in his work on "Modern War":

"The general staff at Berlin contains three sections specially

charged with attentively following all military movements both at home and abroad, for the purpose of keeping themselves informed concerning everything touching organization, recruitment, armament, equipment, the geographical configuration of neighboring countries, the construction and demolition of fortresses, the development of ordinary roads, railroads, canals, etc.

"The countries of Europe are distributed among these three sections and form subjects of special study.

"This organization has been adopted by all armies since the success of Prussia demonstrated its utility."

Reconnaissance, then, is carried on in time of peace by the military branches of all foreign services as an important, a necessary preparation for war, despite the fact that general military reconnaissance can, to a considerable extent, be carried on after war breaks out. It is vastly more important that preliminary naval reconnaissance should be so conducted, for after war breaks out, all naval reconnaissance is blocked at the shore line; yet it seems that thus far no nation in the world has a thoroughly organized system of naval reconnaissance as a preparation for war. This is due to the fact that, until the publication of Captain Mahan's great work, only a few individuals ever realized the influence, the importance of sea power. As might have been expected, Germany then saw at once that what had so largely contributed to her victories on land, must form part of her preparation to fight battles on the sea, so that her Naval General Staff is now working, just as the Prussian Military Staff did before 1870, at preliminary reconnaissance as part of its preparation for naval war, and several other countries are unquestionably following Germany's example.

Our neglect of naval reconnaissance has not yet resulted seriously, because, until now, we have been an isolated power in the community of nations, content to keep our enemies from our home coasts and to busy ourselves with internal development. Now, that condition has passed away. We have taken a colonial empire from a decadent world power, and on the confines of that empire we find ourselves touching elbows with every nation in the world. Our commercial and political relations with other powers are now so interwoven that war may threaten with any of them when our national interests are divergent from theirs. We should, therefore, hasten to repair the neglect of more than

a century, and begin at once, in a comprehensive, systematic way, to learn where and how best to carry war into countries beyond the seas. Colonel G. A. Furse, in his valuable work on "Lines of Communicating in War," says:—

"The disembarkation of an expeditionary force may have to be effected in a country of which we may possibly have a very superficial knowledge. . . . In cases of this kind, it becomes essential to have careful reconnaissance of the coast made by naval and military officers, to whom should be entrusted the selection of a suitable place for landing, which may subsequently be turned into a base of operations, if necessary. . . .

"Sound arrangements at the base of operations are impossible unless we have a correct idea of all the difficulties which we shall have to contend against, for without this it is obvious that we shall never be in a position to devise the most practical means for overcoming them."

Even more pressing to us just now is the necessity for learning how to prepare to defend our new and distant possessions, for these will be jeopardized first, in the event of a maritime war, and they are of vital importance to us in carrying on such a war. Our most exposed, and, strategically, our most important outlying possession today is the Philippine Group of islands. We should select in it, without delay, the tactically strongest locality for a naval base, in the best strategic position. There are scores of excellent harbors among these islands. All should be visited and most of them examined by careful reconnaissance before a selection is made; for if we miss the key by a hasty selection, our opponent will probably seize it when war comes. I have already said that other nations have not neglected reconnaissance as we have. I have seen British, German and Japanese naval officers, many miles from harbors in which their ships were lying, equipped with bicycles, cameras, sketch pads and compasses, busily engaged in studying the characteristics of the country about them, while midshipmen and warrant officers were keeping their ships swept in their absence.

I repeat that in selecting a naval base in the Philippines we must be absolutely certain that tactically and strategically we have selected the best, for when war comes, our opponent in those waters will assuredly make for himself a selection from among the harbors we fail to fortify.

The Aleutian Islands loom up in strategic importance when our eyes turn to the Far East; yet, in spite of the almost countless naval vessels which we have sent from time to time for various purposes into Bering Sea, we know next to nothing of these islands and their harbors. We have been content to leave them shrouded in fog and obscurity; but the big merchant steamers of Great Britain and Japan are sighting them almost daily. They are half way stations on the shortest highway between us and Asia, and must assuredly be used by ourselves or our enemies whenever the Pacific becomes our theater of war. There are probably not half a dozen captains in the United States Navy today, who, if passing the Aleutians with a convoy, would know in which island they could find the best shelter for coaling and refitting.

We still have much to learn of the Hawaiian Islands and of our West Indian possessions, as well as of the harbors of our continental coasts; in fact naval reconnaissance at home and abroad has been, as I have endeavored to show, entirely neglected. How then should we go about this imperatively necessary preparation for war?

Instructions for reconnaissance duty have been prepared at the Naval War College, and each summer the class, in attendance has been sent out for a few weeks at a time to make practical application of them in the vicinity of Newport. Instructions of a similar nature were formulated several years ago in the Office of Naval Intelligence for the guidance of intelligence officers afloat, but their importance has been so little appreciated that they are the least heeded of all intelligence instructions, and now need revision. These two sets of instructions, compared and revised, should be sent by the Navy Department, as confidential matter, to commanders-in-chief and commanding officers of vessels in commission. It should then be ordered, and the order should become a paragraph of the naval regulations, that whenever vessels of the navy are lying in port in time of peace, the senior officer present shall direct that watch officers be, as far as practicable, relieved from watch duty by junior and warrant officers, and shall assign them to a reconnaissance party under the direction of the senior member, which shall draw up and carry out a systematic scheme of naval and military reconnaissance in accordance with the "In-

structions for Reconnaissance Duty," and make a report on the same, embodying all sketches and plans formulated for offense and defense; such work, however, not to relieve officers from regular forenoon or special drills, when this can be avoided. The reports should be confidential and in quadruplicate, one copy going to the Navy Department, one to the Naval War College, one to the flagship of the station, and the remaining one to be deposited, under seal, in the safe of the chief official in charge of the maritime interests of our government in the port examined (for example, the U. S. Consul, or the Captain of the Port, according as it is a foreign or a home port), for inspection and revision by the next reconnaissance party visiting that port.

I have said that both a naval and military reconnaissance should be made by these parties, because no representatives of the army are likely to visit foreign ports or even ungarrisoned home ports in an official capacity in time of peace, and the navy may have to convoy and land the army before it can begin operations in time of war. It is, therefore, important that whenever possible a marine officer should be a member of the reconnaissance party.

The intelligence officers should also be members, and such portions of the information obtained as they might select, or perhaps all of it, should go through the usual official channels to the Office of Naval Intelligence.

In a reconnaissance, to be thoroughly successful in execution and valuable in results, the following conditions are necessary:—

(*a*). Previous careful study of the best charts and maps of the locality.

(*b*). Distinct orders to all detachments of a party as to what is required.

(*c*). Thorough equipment.

(*d*). Some aptitude in free hand sketching.

(*e*). Ability to ride a horse or a bicycle, or both.

(*f*). Familiarity with the language of the country.

(*g*). Tactfulness.

Instead of discussing these questions in the order named I will take up the subject of free hand sketching. Such work done in reconnaissance by one whose intelligence has been tactically trained will prove a saving in time and labor, and the quickest and surest way of conveying much of the information he gathers.

Captain E. A. Root, U. S. A., in his work on "Military Topography and Sketching" says, on the subject of reconnaissance:—

"However pressed for time one may be, *he should try* to convey as much information by *a sketch* as circumstances will permit."

In a reconnaissance of a harbor, two or three profile sketches from the various directions of approach by sea, and a birdseye sketch from the most commanding height in the harbor's environment would often save many pages of tedious description; but the officer making the sketch must fully understand the purposes for which it is made and the details needed for such purposes. To this end his education in this line should begin at the Naval Academy, and in the Department of Drawing at that institution such works as those of Captain E. A. Root, U. S. A., and Major H. D. Hutchinson, R. A., should be used as text-books, and sections should be taken out frequently along the Severn River and Chesapeake Bay for practical exercise in reconnaissance-sketching and the use of all reconnaissance equipment.

Of course such work can often be much better done with a camera, but a camera is not always available, not always in order and not always convenient to handle. Moreover, it is frequently handicapped by the caprices of the weather, such as cloudiness, rain, haze, the relative direction of the sun or the prevalence of a strong wind. Nevertheless a section at the Naval Academy, while doing practical work in reconnaissance-sketching, should also receive practical instruction in reconnaissance-photography, This practical work in the *application* of the art in the Department of Drawing need not conflict with the *teaching* of the art by another department, if that is now the case.

Reconnaissance should not be confined to the immediate vicinity of a port, but should extend ten, twenty or a hundred miles around it, if necessary, to develop any important tactical characteristics. Money should be made available, either from the naval contingent or a specially appropriated fund, to equip reconnaissance parties and to pay all their expenses of travel and subsistence. Each member of a properly equipped party should have: 1 bicycle, with cyclometer; 1 sketch pad; 1 note-book; 1 foot rule; 1 pocket compass; 1 pocket aneroid barometer; 1 pair binoculars; 1 pocket camera; 1 road map of the locality; a passport; and the chief of the party should be authorized to pur-

chase, at government expense, any local maps, plans guide books, prospectuses or statistical compilations c information which he thinks valuable.

In time of peace naval reconnaissance can be conduc more certainty as to the importance of localities than tary reconnaissance; for while it is impossible to for particular spots in a vast *area* of land will be battlefiel future, it is not impossible to pick out all probable battl in a *line* of coast.

In making up a plan of reconnaissance for a particu its strategic importance should first be considered; *i. e.*, tion, its strength and its resources. Questions such a lowing should be discussed and settled:

If a foreign port,

Would it lie upon our line of communication in the war?

Would it strengthen our enemy's communications?

Would it threaten our commerce by harboring the destroyers?

Would it protect his commerce?

Would it cover the enemy's capital or important strongholds?

Would it form a good base for his naval operations?

Would it form a good base, if seized, for ours?

Are its resources essential to the maintenance of the fleet?

Would they be of great value to our own?

These questions settled, the purpose and extent of reconnaissance will be well defined; *i. e.*, it will be with a isolation, or to blockade, or to bombardment, or to ass assault and capture, or to seizure and improvised or pe defense.

Most of our wars and expeditions, on account of our i by seas, must, if carried on aggressively, begin on the s distant lands, and we should be prepared, in the event with any nation in the world, to select at once, in the country, a sea base of operations. Furse says, in regard selection:

"What is needed is a port which will satisfy three p conditions, viz., it must be favorably situated with respec

direction of the line of operations; it must offer a safe anchorage to a large number of ships; and it must possess great facility for landing troops of all arms, and large quantities of war materials and provisions."

On the other hand, we should know of our own ports; their strategic characteristics making their defense necessary or neglectable and suggesting the character and extent of defense when necessary; and in this connection the navy should not be deterred by false delicacy from pointing out to the army, from a naval standpoint, any inadequacies discovered in the existing defenses of our coasts.

Reconnaissance should be conducted as unostentatiously and cautiously as possible, and with entire courtesy towards all people met, and with due deference to local lawful restrictions. Little will be learned after one is regarded with suspicion or arouses antagonism. Instruments other than those carried by ordinary tourists should be displayed as infrequently as possible. The memory should be trained to carry all memoranda until it can be transferred to a note-book in privacy. Distances can be quite accurately measured unknown to onlookers by counting one's paces, if the average length of pace is obtained in similar ways; such as with the sole of the shoe, the forearm and hand, a pencil or an umbrella. Bearings can be obtained approximately with a watch, if the sun is not too directly overhead.

The best available charts or maps of a port or locality should be studied, and reference books consulted, in drawing up a plan of reconnaissance. In general, the information to be obtained is as follows:

The location of forts and batteries defending the locality; their armaments in detail; their heights above water; their approaches from sea and land; the arcs of train of their guns and the areas controlled by their fire.

The positions of magazines, storehouses and barracks, and their equipment in material and personnel.

The location or plans of mine fields, operating stations, torpedo batteries and searchlights, and details of their equipment.

The location and characteristics of landing places for an attacking force, and of unfortified points, which, if taken, would command the defenses.

The location and characteristics of defensive positions which would naturally be held by mobile forces.

The location and characteristics of sites for camping grounds and for field hospitals.

The location, equipment and resources of manufacturing, repairing, coaling, watering and lighting plants.

The number, tonnage and speed of local steamers, ferryboats, tugs, yachts and launches, and the number and tonnage of all sailing craft, barges, lighters, etc.; also their draft.

Roads; their directions, nature, width, condition of repair, grades, intersection with other roads; how bordered; where they pass through defiles or cross streams or railroads.

Railroads; their direction; number of tracks, guage, grades, junctions, stations, cuts, embankments, tunnels and the number and capacity of locomotives and cars.

Bridges; their position, construction, height and width of spans; the load they will bear and their fairway width, and the characteristics and location of positions commanding the bridge heads.

Rivers and streams; their direction, width, depth, fords, rapidity of current, fluctuations in depth (indicated often by drift-wood), nature of banks; location and nature of islands in them. heights and cover commanding channels; character of the water (potable or otherwise).

Woods; their situation, extent and timber; whether clear or containing underbrush; location and extent of clearings, ravines, marshes, etc.

Canals; their direction, width and depth; location and length of locks; condition of towpath; location and height of bridge arches over them.

Routes of telegraph and telephone lines; number of wires and location of stations.

Villages; characteristics of their situation and architecture; width of streets and materials of pavements; location and nature of buildings commanding best view of surrounding country, or specially suited for strongholds.

The location and characteristics of defiles, ponds, marshes, springs, valleys, and heights; always noting from the latter what other heights or landmarks are visible.

The nature of cultivation.

Information concerning climate, weather, healthfulness and local food supply.

It is to be kept in mind that most of this information is to facilitate the movement of troops and supplies from a landing place to a field of operations, and to place the troops in possession of the commanding positions on that field. The officers making such reconnaissance must have some knowledge of what troops can do on a march, what inclines they can ascend or descend, what depths they can ford; the extent of obstructions which will bar the way to various kinds of impedimenta. For example, they should know that the limit of fordable depths is laid down as 3 feet for infantry, 4 feet for cavalry and 2½ feet for guns; that 3 inches of sound ice is regarded sufficient to bear infantry and field artillery, and 7 inches sufficient for heavy guns; and that slopes up to 15 degrees are practicable for movements of all arms in close order, thence to 30 degrees are traversible only in irregular formations, and thence to 45 degrees can only be climbed singly.

In this connection it is important to note, of villages, if the houses are compactly grouped, or straggling, or strung out. and, if the latter condition prevails, whether the attenuation is along a line of march or at right angles to it. It is important to take note of similar characteristics in woods and marshes.

In judging of camp sites it is important to note the drainage, dryness of the ground, etc., for sanitary purposes.

All chart data and sailing directions should be verified or corrected and made complete.

My resumé of information to be obtained by reconnaissance is not complete, but serves to show how much is to be sought in a thorough reconnaissance. Some of it seems at first sight to be out of the province of a naval officer, but as he alone, in most cases, has the opportunity to obtain it on foreign shores, *he* must do it if we are to have such information at all.

As already suggested, our most pressing need for reconnaissance today is to select permanent bases in our new possessions. In considering harbors for this purpose they can be divided into four classes:

1. Single exit harbors.
2. Double or multiple exit harbors.
3. Single basin harbors.
4. Double or multiple basin harbors.

Class No. 4 may be subdivided into—

a. Serial basin harbors.

b. Radial basin harbors.

The following will serve as illustrations:

No. 1: San Francisco, Santiago de Cuba, or Subic Bay.

No. 2: New York, Kure, Hong Kong and Ilo Ilo. No. 1 and No. 2 illustrations are also single basin harbors.

No. 4*a*: Malampaya Sound, Philippines, and Guantanamo, Cuba.

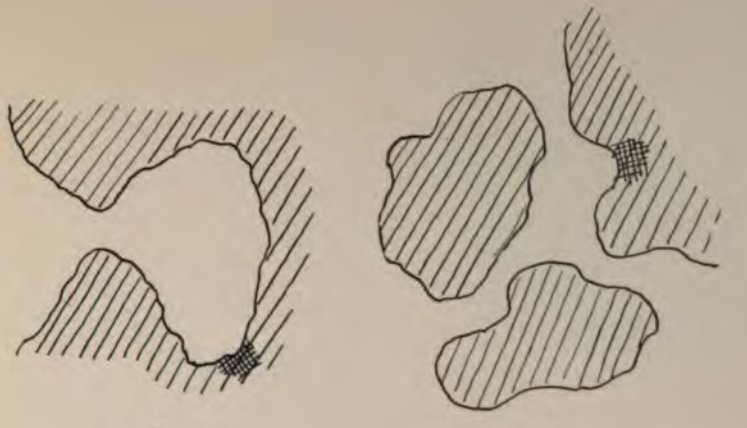
No. 4*b*: Pearl Harbor, Hawaii, and Sam-Sa Bay, coast of China.

Tactically, the ideally strongest harbor for a permanent naval base would be of the multiple, radial basin kind; the exits being numerous, fortified and debouching far apart; the basins so located as to be masked in the directions of the exits.

If the exits debouch a hundred miles or more apart it would require a force at every exit equal to the force inside, to effectually blockade it, or, in other words, the blockading force would have to be as many times greater than the blockaded force as there are exits. There are very few harbors possessing more than three exits; in fact I cannot call to mind any. Nantucket Sound and Kure are examples of those having three. It is great tactical good fortune to be able to select one having even two. We have but two such localities on our Atlantic coast, Long Island Sound and Nantucket Sound (excepting a small one in Penobscot Bay), and there is but one, Port Orchard, on our Pacific coast, which, after all, is itself enclosed by a single exit harbor. Japan is lavishly blessed with such harbors on her Inland Sea.

If we are forced to select a single exit harbor, it should be one whose inner basin is not open to reconnaissance or bombardment through its exit; one shaped like Pago Pago, for example, which is L shaped, the axis of the inner basin being nearly at right angles to the axis of the exit. The exit must be narrow enough to be controlled by gun fire, and not too deep for mines, and it should rapidly widen beyond the line of fixed defenses, so that a fleet issuing forth could quickly deploy into any line of battle. It should widen just as rapidly into the harbor itself, so that the period of constriction during exit may be the briefest possible.

A serial basin harbor affords natural lines of fixed defenses at every point of constriction between the basins. If only one of



1.

2.

3.

4.

5.

these lines can be defended it should be the outer one, unless the next inner one possess such superior characteristics that it can be made much the stronger, and that its defenses make the outer basin untenable to the enemy; for it is imperative that the latter should nowhere find undisputed harbor in the vicinity of his blockade.

A radial basin harbor may possess advantages over a serial basin harbor, if all basin entrances are defended and there are water traverses connecting the rear ends of the basins, for then the blockaded fleet would still possess some mobility after the outer exit had been carried, especially in torpedo boat attack, which might be made upon the enemy from any or all of the basins having connections in their rear.

The first considerations in the selection of a permanent naval base are, of course, strategic.

It should be on or near our lines of communication.

It should be centrally located, with reference to all routes by which the enemy might enter the area under its control.

It should include within its fixed defenses a district of domiciled, skilled labor, and resources for subsistence and repair.

Let us take, for example, the Philippine Islands. Our lines of communications through the group to any theater of opertions on the Asiatic coast would run from Guam through the Strait of San Bernadino or Surigao. Thus, we see, they would pass just north and just south of the island of Panay. Looking next for the most central position with reference to all water routes by which an enemy's naval forces could enter the Philippine group, we find it to be the island of Panay. Looking next for the centers of domiciled skilled labor in the islands, we find there are but two; Manila, in Luzon, and Ilo Ilo, in Panay.

All strategic considerations have, then, pointed to the island of Panay. We have next to look for its harbors. It has but one worthy of the name, Ilo Ilo; let us then examine its tactical characteristics.

It is a single basin, double exit harbor; the exits debouching nearly thirty miles apart at the north and south ends of the island of Guimaras. The harbor is completely masked in a semicircular bight of Guimaras, and the exits are suitable for the strongest defenses of all kinds. We might be well content with these characteristics, but, looking a little closer, we find only a narrow

strait between the small island of Guimaras and the large island of Negros, and this strait has only 17 feet of water in its deepest part. Ilo Ilo is then, tactically, a harbor enclosed between the islands of Panay and Negros, with exits separated by almost the entire circumference of either of those islands; in other words, its exits debouch three hundred miles apart.

Having by a general reconnaissance selected the strongest strategic and tactical locality for a naval base, further special reconnaissance must be made to select sites for drydocks, repair shops, coal wharves and sheds, reservoirs, barracks, magazines, storehouses, and hospitals. The local hydrographic and topographic conditions must largely govern in this, but there are tactical conditions too, which must not be disregarded.

1. The site should be safe from bombardment by blockading vessels, and should be naturally masked from outside reconnaissance.

2. The establishment should be so laid out that there will be no congestion of vessels along its water front.

3. If there is a choice between an insular and a continental side of the harbor, the former should generally be chosen, especially if the base is in an unfriendly or insurrectionary country. This was found necessary by the British at Hong Kong.

4. The site should be so located that projectiles aimed at its defenses will not place its establishments in jeopardy.

The site having been selected, reconnaissance for its defense is next in order. It may be claimed that this is work for the army engineer, but he will not be on the spot, and may never be sent to the spot until the naval officer there calls attention to its tactical defensive characteristics. Naval reconnaissance must, therefore, select the general locality, leaving to the engineer's technical knowledge the adoption of the exact sites. In selecting a general locality for fixed defenses the following conditions suggest themselves:

(*a*). The first site to be selected is one which gives axial fire down a channel, such as an island in midchannel or a point of land projecting into it.

(*b*). The next position should be one whose fire will cross the axial fire of the first, *i. e.*, on one bank or the other of the channel, and it should be close enough to the first to deliver its most effective fire simultaneously with that from it.

(*c*). The choice between banks being otherwise equal, it is better to place all batteries on one bank only, instead of dividing them between the two, for this will concentrate all fire upon one side of an incoming fleet, and permit it to fight but one broadside in return. It also eliminates the possibility of batteries firing into each other, and facilitates intercommunication and control of fire.

(*d*). There should be fixed defenses on any salient point causing a sharp bend in a channel.

(*e*). There should be fixed defenses commanding the offing, especially if it contains anchoring ground.

(*f*). The height of fixed defenses above water must not be too great for guns at extreme depression to cover the nearer side of the channel.

(*g*). In selecting heights for fixed defenses, that one should be chosen (if not too high) which commands all others in its neighborhood; otherwise provision must be made to hold the position commanding the selected site with an adequate mobile force.

(*h*). It should be arranged that the aggregate fire from all batteries in supporting distance of each other in any locality shall be at least superior to the broadside of two standard battleships, especially in lighter caliber guns, which cannot be too numerous.

(*i*). The caliber of guns in a battery should be in proportion to the range within which the constriction of the channel will compel the enemy to pass.

(*j*). Sites must be selected for searchlights and mine fields, and for batteries to cover the latter.

Many portions of our new possessions are incompletely or inaccurately surveyed. This is also true of many other parts of the world, especially those waters of Asia which are now near the focus of international speculation. Surveys must be preceded by reconnaissance, and the outcome of the surveys will be charts and sailing directions. On the threshold of such work we should realize, that *charts and sailing directions are weapons of strategy and tactics.* A hydrographic chart prepared by or for the navy should be as complete a military map as one prepared for a land campaign. Its features should not cease at the shore line, but every characteristic of contour, roadways, streams and bridges, fords, woods, swamps, cultivated fields, villages, tele-

graph, etc., within the area covered should be shown. The scale and size of charts should be an outcome of strategic study. Sailing directions have an equal military value. Unfortunately, with the decadence of sail power, they have grown briefer and briefer, but it should not be so. Sailing directions should be regarded as supplemental reports of naval reconnaissance and should be prepared accordingly. This emphasizes the fact that hydrographic surveying should be conducted by naval officers, for it is essentially and especially strategic work.

Of all things which contribute to the success of a military undertaking, preparation is most important, and to no country is preparation more important than to ours, with our meager experience, our naturally peaceful pursuits and our new and dangerous propinquity to the great nations of the world. A former president of the War College has given the formation of plans of operations as one of the three principal branches of preparation, and he places the study necessary to the formation of such plans under three heads, historical, statistical and geographical. Von Moltke has declared that geography is three-fourths the science of war, and the only way we can study geography for military and naval purposes is by reconnaissance. The Prussian staff officers devoted themselves to elaborate studies of strategy and geography, not only by means of books, but by travel, and following in person each campaign. Dr. T. Miller Maguire, in his "Outlines of Military Geography" speaking of the rapid triumph of Prussia over France, in 1870, says:

"How was this? Simply because for a generation the leaders of the German race had devoted themselves with constant zeal to profound studies of strategy and military geography in all its bearings, and during the struggle had acted on the knowledge thus acquired. They were ready for war in its most highly developed form; their adversaries were neither as well trained nor as well prepared. There was no other reason." What the Prussians did, the Germans are still doing, and the British and Japanese are learning to do likewise. Can we, who are elbowing all three nations with a jealous fear that they are crowding us, afford to be behind them in any branch of preparation for war?

The United States has led the world in the study of the art of naval warfare, and this study brings out clearly the analogy of methods on sea to those on land. Von Moltke has shown that

preliminary reconnaissance is one of the greatest sureties of success in land campaigns. Let us who follow the sea be no longer blind to the lesson which this, by analogy, teaches, but let us get away among the first on the road to preparation in this important field. After a few years of such work if carried on energetically and systematically, there would be, in the cabin of the commander-in-chief or senior officer present on every one of our warship stations such carefully prepared information concerning every locality within the limits of the station that if war came like a thunderbolt from a clear sky his plan of action could be correctly mapped out while getting up anchor.

Never more keenly, perhaps, has the lack of preliminary naval reconnaissance been felt in our service, than by the staff of the commander-in-chief of the naval force on our Asiatic Station when war so suddenly threatened with Spain in the spring of 1898. On February 25 of that year the following telegram was received:

"DEWEY, HONGKONG:

In the event of war with Spain, your duty will be to see that the Spanish squadron does not leave the Asiatic coast, and then offensive operations in the Philippine Islands.

ROOSEVELT."

Here was a theater of operations outlined with mandatory abruptness. What was known about that theater? Only what could be gleaned from unreliable charts and antique sailing directions. The fortifications of Manila and Cavite had been open to inspection for a decade of peace years, and the characteristics of Manila and Subic Bays, of Ilo Ilo and other ports, could have been studied from the days of Perry, but no American Von Moltke existed in our navy. It was too late to begin naval reconnaissance then; in fact, as we all know, relations between the two countries had been so long strained that it would have been too late a year earlier. There was but one possible way to make up in some degree the lack of knowledge, viz., through the U. S. Consul at Manila, a man naturally in no sense trained for military or naval reconnaissance. Consequently we soon find the following sequence of telegrams:

"WASHINGTON, April 24, 1898.

"DEWEY, HONGKONG:

War has commenced between the United States and Spain. Proceed at once to the Philippine Islands. Commence operations at once,

particularly against the Spanish fleet. You must capture vessels or destroy. Use utmost endeavors.

LONG."

HONGKONG, April 25, 1898.

"SECRETARY OF NAVY, Washington:

The squadron will leave for Manila, Philippine Islands, immediately upon the arrival of the United States consul from Manila.

DEWEY."

HONGKONG, April 27, 1898.

"SECRETARY OF NAVY, Washington:

Williams, the United States consul from Manila, has arrived. The squadron will sail immediately for the Philippine Islands.

DEWEY."

Extract from Commodore Dewey's report on the Battle of Manila:

"The squadron left Mirs Bay on April 27, immediately on the arrival of Mr. O. F. Williams, United States consul at Manila, who brought important information and who accompanies the squadron."

Here, then, was a commander-in-chief, one of the most energetic, audacious and resourceful our navy has ever produced, fully ready for battle in all other respects, compelled to wait two days after urgent commands to open his campaign, in order to obtain that knowledge of the enemy's country and resources which, had our navy had a system of preliminary reconnaissance, should have been lying all the time in a drawer of his desk. The information finally obtained was as it could not otherwise be, so meager and imperfect that only the inspiration and resolute action of our great leader made our success complete.

The inadequacy, indeed the paucity, of our topographical knowledge of the environment of Santiago de Cuba in the spring of 1898, is well known, and the impossibility of completing such knowledge after war broke out was fully demonstrated. Let us take to heart the lessons thus taught and try to realize how narrowly we escaped the consequences of our neglect, and let us begin at once with the utmost effort to repair that neglect before we are again caught in the predicament of war.

Preliminary reconnaissance is practically at an end when war becomes imminent. Tactical reconnaissance may begin when war breaks out, but there are widely different limits to naval tactical reconnaissance and military tactical reconnaissance. The latter, conducted on land, with many chances of concealment, and in frequent touch with disaffected people in the ene-

my's country, will generally result in much valuable information, sometimes going far toward making up for the neglect of preliminary reconnaissance, but naval tactical reconnaissance must be confined to the enemy's coast line, with no possibility of concealment and with little intercourse with noncombatants on shore. There may be occasional daring and fruitful exploits like that of Lieutenant Blue at Santiago, and Lieutenant Ward in Porto Rico, but they can only at best be rare. Beyond such, nothing can be done except to draw the fire of the enemy's batteries and fortifications as was done by Admiral Sampson at San Juan, and endeavor in the excitement of action to locate gun positions and estimate the caliber of the projectiles hurled from them. Of the San Juan bombardment Admiral Sampson reports:

> "I determined to attack the batteries defending the port, in order to develop their positions and strength, and then turn to the westward."

Twelve hundred and twenty-five projectiles were expended upon San Juan for this purpose, with the result that "all the shore batteries had been developed, and they were more numerous than the information received had led me to suspect" (Admiral Sampson's report). One man had been killed in this reconnaissance, and seven or more wounded, while seven U. S. warships had been for two and a half hours in danger of destruction. Such is the risk and cost of tactical naval reconnaissance, and such are the meager results when it is made to repair the neglect of reconnaissance preliminary to war. Had there existed in our navy a well developed system of preliminary naval reconnaissance, even for but five years previous to 1898, Admiral Sampson might have had the information he sought before the war broke out, and it would have cost less than fifty dollars.

For the navy, *tactical* reconnaissance can never make up for the neglect of *preliminary* reconnaissance. The chief value of naval tactical reconnaissance and reconnaissance in force will be to gain information concerning the enemy's fleet and other forces on the seas.

I present this paper in the hope that it may be a seed which will quicken into a system of naval reconnaissance in time of peace unequalled in its scope and completeness by any in the world, for "in nothing more than in war, knowledge is power."

A NEW RIVER GUNBOAT.

A shallow-draft river gunboat, one of two just built for the British Government by Messrs. Yarrow, was taken for a trial run in the Thames from Greenwich to Gravesend and back on Saturday afternoon, when there were present on the ship among others, Adm. Sir R. H. M. Molyneux, Vice-Adm. Morant, the Turkish Ambassador, Capt. Schilling (French Naval Attaché), Com. Schwarz (Austrian Naval Attaché), Com. Kawashima (Japanese Naval Attaché), Capt. T. Matsuo (Japanese Chief Naval Constructor), Sir Hiram Maxim, and Prof. W. C. Unwin.

The great feature of the Teal, as the vessel is named, is the smallness of her draft, which does not exceed 2 feet 3 inches; on her official trials, indeed, it was only 2 feet 2¼ inches with a load of 40 tons on board, and yet the mean of six runs on the measured mile showed a speed of 13.045 knots, or 15.014 statute miles an hour. This speed was attained without forced draft and when the fuel burnt was wood. The Teal is 160 feet long and has a beam of 24½ feet. Her hull, which is of galvanized steel, is divided into ten water-tight compartments, each of which is an independent flotable section—a system of construction which enables the vessel to be put together while afloat and avoids the inconvenience of riveting up and launching in localities where skilled labor may be unobtainable. There are two screws, driven by two sets of compound surface-condensing engines which run at about 300 revolutions a minute. These screws are much larger in diameter than the draft of the ship, and revolve each in a special tunnel designed to secure that they always work in solid water. Access to them is gained by manholes on the main deck, and it is stated that only 20 minutes are required to remove a propeller and put another in its place.

Steam is supplied by a pair of Yarrow water-tube boilers, and the forced draft which is provided for, though not necessary for the maintenance of full speed, will be useful when the wood fuel available is green or of poor quality. The guns, which

consist of two 6-pounder q. f. and six .303 Maxims, are mounted on an upper or battery deck which extends about half the length of the ship, and being completely housed in, provides spacious quarters for Europeans; its bulwarks, like the sides of the vessel in way of the machinery and the cabin accommodation for the officers on the main deck, are protected by Cammell chrome steel of such thickness as to be proof against rifle fire, point blank, at close quarters. Aft on the main deck there is accommodation for the native crew and also a special sick-bay. The ship is fitted with no fewer than four rudders, all controlled by the usual steam and hand gear. These give extraordinary command over her steering; indeed, it is possible to make her describe a complete circle in little more than her own length—*The Times*, London, June 24.

BRITISH GUNBOAT, TEAL.

DISCUSSION.

CAPTAIN F. E. CHADWICK'S LETTER. See No. 98.

Lieut.-Commander C. N. ATWATER, U. S. N.—Captain Chadwick's views, as expressed in his timely letter, bring before the service a question of very great importance. Another important question, as to whether we shall train apprentices or landsmen, is not asked, and cannot, perhaps, be pertinently discussed in this connection; but I desire to preface what I have to say by endorsing Captain Chadwick's views concerning the training of apprentices.

The remarkable physical development which takes place among the lads on a sailing training ship in the short space of a summer or a winter cruise seems to me without a parallel in other educational institutions, afloat or ashore. This development in size and weight, in strength and activity, has recurred under my observation on successive foreign cruises, and I am convinced that it need never fail to recur if the cruise is a foreign one and if not less than half the time be spent actually at sea.

I emphasize the point that the cruise should be foreign because, of ten sailing training cruises I have made, the only two which failed to secure excellent results were along our own coast. In these two cruises there were constant restlessness and frequent desertion. The boys are always unsettled or seasick or homesick at first, and if they are in home ports they are apt to get away. If they are in foreign ports they are attracted by their novel surroundings and gradually become reconciled to the life they are leading on shipboard. The present excellent barrack training ashore followed by a foreign cruise with long periods at sea minimizes desertion and makes it possible to keep the boys interested until they are given leave before being transferred to general service.

As some officers are opposed to training apprentices in sailing ships on the ground of waste of time, I wish to give it as my belief that only four months are absolutely necessary to secure the results that advocates of sailing training ships hope to obtain. A ship sailing for the English channel in June is ready to transfer her apprentices on arrival at Hampton Roads on the 1st of November; one starting on January 1st for the West Indies has hers ready to transfer at Hampton Roads early in May. This leaves two months in which to reach a navy yard, attend to necessary repairs, lay in stores and proceed to Newport for the next lot of boys. This schedule permits of two cruises annually, and any deviation from it results in the loss of a class; the time allowed is barely sufficient for training and for refitting. It has the fewest possible drawbacks as to seasons and weather. It is a regular plan which makes it possible to keep the boys interested until they are transferred.

Other than physical benefits to the apprentices are, of course, less strikingly apparent; but it seems to be the general opinion of officers who have served in sailing training ships that the boys are rendered

alert and active, mentally as well as physically, that the life makes them courageous and quick-witted in emergencies and develops self-respect and manliness.

The preliminary training at the station now leaves little to be desired. There are progressively fewer boys each year in the drafts who are lacking in physique, capacity or ambition, or who are incorrigibly bad. The average draft is now a well-disciplined and tractable body of clean, decent young Americans who develop rapidly into very respectable seamen and excellent marksmen. Our warrant and petty officers who are ex-apprentices are the best argument for a continuance of the present training in sailing ships.

It is my earnest conviction that Captain Chadwick is wise in advocating sailing training ships and in maintaining that equally good results cannot be obtained by using vessels with steam power. Boys must be kept interested and occupied while they are being saturated with salt water, and they are less likely to be aware of the pickling process on a sailing ship than on a steamer, where equal results can only be obtained at a greater expenditure of both time and money.

Discussion by Lieutenant M. Wyt, Dutch Navy, of lecture by Lieutenant L. H. Chandler, U. S. N., on "Torpedo Operations in Naval Warfare." This discussion accompanied a translation of the above lecture by Lieutenant Wyt which appeared in the *Marineblad*, a Dutch naval magazine, printed at Helder, Holland.

In commencing his translation, Lieutenant Wyt says: "On August 6 1901, Lieutenant L. H. Chandler, U. S. N., delivered a lecture on 'Torpedo Operations in Naval Warfare' before the U. S. Naval War College at Newport, R. I. As a matter of fact the lecture must be understood by the readers of the *Marineblad* as applying to conditions existing in the United States, and it must be born in mind that everything that is true for the other side of the ocean is not always necessarily applicable to the Dutch Navy."

In concluding his translation, Lieutenant Wyt sums up as follows:

"The question of the adjustable gyroscope has also been under consideration by the Dutch commission charged with the regulation of the torpedo service, and it is regretted that, owing to its confidential nature, any discussion of it must be omitted.

"Mr. Chandler's lecture seems to me unusually interesting because he discusses the most modern improvements of the torpedo, and our war ships and torpedo vessels are fitted with weapons of the types discussed in the lecture. The diagrams show that the American Morris is very similar to our Scylla and Hydra, and I judge that our Xa, Xc and XI torpedoes are very similar to the American Whitehead, 5 metre, Mark I.

"In spite of the similarity of outfits, I suppose the Dutch navy must consider the question from a Dutch point of view, and from that point of view a section of seven boats is too large, even had we the necessary boats at our disposal. The narrow passages between the Dutch banks would not permit of such a gathering of boats, as such a large section would be unable to disperse sufficiently before coming under the guns of the enemy's ships on that account.

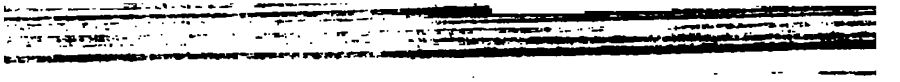
"It also seems to me to be a great pity to launch twenty-one torpedoes at the same moment. If the distance, speed, etc., of the antagonist have been correctly estimated, then several torpedoes will hit the target, but if there has been some mistake, then the whole section is put out of action in a moment without accomplishing anything. I prefer the system in our navy, where the torpedoes are launched at certain intervals.

"A great advantage of the adjustable gyroscope seems to me to be that, while using above water tubes, it is possible to run all of the torpedoes directly ahead. When launching the two bow torpedoes in that way, a danger zone is obtained of sufficient width to neutralize errors in judgment in pointing. This right-ahead fire seems to me the simplest to deliver, especially when it is hard to judge bearings, distances and speeds at night and under search lights and gun fire. In that case I suppose the ahead fire will give the best chance of success. I therefore believe that the Hydra and Scylla would be improved were they fitted with the adjustable gyroscope.

"I believe that the gun will always be the deciding factor in every naval engagement, and that the torpedo and ram can only come into play secondarily for a large ship. I am of the opinion that every commander will be obliged to manoeuvre mainly to make his gun fire tell, and that the ram and torpedo must wait for their opportunity during the melee at the end of the battle.

"I cannot understand how Mr. Chandler can reset his adjustable gyroscope in a very short time, especially with the submerged tube. It is clear that he intends to put his torpedoes in the tubes before the action opens, and that is the only proper way. The quick changes during the different phases of the fight would make it very unwise to put one of your torpedoes out of action for a short time to reset it, especially when you are driven to bay by a powerful enemy. Only the attacking party will have the time to spare five or ten minutes for resetting the gyroscope, and I suppose five or ten minutes would be a minimum for a submerged tube.

"I sincerely hope that Mr. Chandler's very interesting paper has shown to the readers of the *Marineblad* that in the American Navy there is a strong inclination to secure a prominent place for the fleet."



PROFESSIONAL NOTES.

Prepared by Lieutenant L. S. VAN DUZER, U. S. Navy.

For convenience of reference these notes are arranged as follows:

A. Notes on ships of war, budgets, and personnel, the notes appearing under the head of the naval power to which they refer. Alphabetical arrangement is followed.

B. Miscellaneous Notes on Armor, Ordnance, Explosives, Torpedoes, etc. The arrangement is aphabetical and the principal heads are:

1. Ammunition.
2. Armor.
3. Boats.
4. Boilers.
5. Canals, Harbors, and Waterways.
6. Coaling Ship.
7. Coast Defense.
8. Communications.
9. Construction.
10. Docks.
11. Electricity.
12. Engines.
13. Fortifications.
14. Fuel.
15. Gunpowder and Explosives.
16. Guns.
17. Guns: Firing.
18. Guns: Mounts.
19. Instruments Used in Action, etc.
20. Machinery (auxiliary engines), etc.
21. Operations (war or manoeuvers).
22. Propulsion.
23. Small Arms.
24. Strategy and Tactics.
25. Torpedoes.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

AUSTRIA.

AUSTRIAN NAVAL BUDGET FOR 1901-1902.—The Austrian naval budget for 1901-1902 was approved May 23, 1901. The total amount appropriated is 46,690,820 crowns ($9,478,236.46; 1 crown = $0.203), an increase of 3,200,000 crowns on the appropriations for 1900-1901. The ordinary estimates amount to 30,803,200 crowns and the extraordinary to 15,887,620 crowns. The principal increases are 1,250,000 crowns for new construction, 200,000 crowns for arms, and 200,000 crowns for maintenance, transportation, and exercise of the fleet. Some of the principal items are as follows:

	Sum appropriated, crowns.	To be appropriated in future budgets, crowns.
In the ordinary estimates:		
For the torpedo cruiser Szigetvar, 4th instalment	200,000	61,810
" ram cruiser E (Ersatz Radetzky), 3d instalment	2,800,000	6,306,000
" battleship A (Ersatz Laudon), 2d instalment	2,600,000	13,600,000
" " B (Ersatz Drache), 1st instalment	500,000	16,900,000
In the extraordinary estimates:		
For the coast-guard battleship Habsburg, 5th instalment.	600,000	60,000
" " " Arpad, 4th instalment	3,800,000	885,000
" " " Babenberg, 3d instalment.	3,800,000	6,275,480
" two monitors for the Danube and five vedette boats (total estimated cost 8,400,000 crowns), 1st instalm't.	400,000	3,000,000
For a steel floating dock	100,000	4,400,000
For the construction of an ammunition store-house, repairs, etc.	128,200	.....

From the budget statement it appears that the new construction to be undertaken during the year consists of a new battleship, two monitors for the Danube, and five vedette boats.

ARPAD: LAUNCH.—The *Reichswehr* states that the battleship Arpad (Battleship II, fully described in PROCEEDINGS *No. 97*, page 151), will be launched September 11, 1901.

FRANCE.

ESTIMATES FOR 1902.—The projected budget (*projet de loi*) for 1902 as submitted to the French Chamber and reported to that body by M. Lockroy, amounts to 312,097,951 francs ($60,234,904.54; 1 franc = $0.193), which is 15,594,579 francs less than the budget for this year; but the cost of the colonial army, about 27 million francs, has been transferred to the budget of the ministry of war, so that in reality there is an increase of about 11.5 millions. The budget makes provision for continuing the program already laid down (see PROCEEDINGS *No. 97*, page 154).

VESSELS TO BE COMMENCED 1901-1905.—The building program (see PROCEEDINGS No. 97, page 154), as developed by the ministry of Marine calls for the laying down of new ships as follows:

At Cherbourg arsenal: In 1901, the submarine boats Naïade, Protée, Lynx, Ludion, Q_{22}, and three others. In 1902, the armored cruiser C_{14}. In 1904, ten submarine boats, Q_{32} to Q_{41}.

At Brest arsenal: In 1901, the battleship République. In 1902, the battleship A_{12}.

At Rochefort arsenal: In 1901, the torpedo boat destroyers Francisque and Sabre; submarine boats Loutre, Castor, Phoque, Otarie, Méduse, Oursin, and Q_{21}. In 1902, the torpedo boat destroyers M_{32} and M_{33}. In 1903, six torpedo boat destroyers, M_{34} to M_{39}. In 1904, eight submarine boats, Q_{42} to Q_{50}.

At Toulon arsenal: In 1901, armored cruiser Victor Hugo; submarine boats Perle, Esturgeon, Bonite, Souffleur, Dorade, Thon, Grondin, Anguille, Alose, Truite, Q_{27}. In 1903, five submarine boats, Q_{28} to Q_{42}. In 1904, eight submarine boats, Q_{51} to Q_{58}.

At Saïgon arsenal: In 1901, torpedo boat 277. In 1902, P_{112}. In 1903 and 1904, torpedo boats P_{139} and P_{177}.

At private building yards: In 1901, the battleship Patrie; torpedo boat destroyers Darde and Baliste at Rouen; Mousqueton and Arc at Chalons; Pistolet and Belier at Nantes; Catapulte and Bombarde at Havre; torpedo boats 266, 267, 268 at Nantes; 269, 270 at Havre; 271, 272 at Chalons; 273, 274, 275, 276 at Bordeaux. In 1902, battleships A_{13}, A_{14}, A_{15}; armored cruiser C_{15}; fifteen torpedo boats P_{97} to P_{111}. In 1903, twenty-five torpedo boats P_{113} to P_{137}. In 1904, thirty-eight torpedo boats P_{139} to P_{176}. In 1905, sixty-two torpedo boats P_{178} to P_{239}.—*Rivista Marittima.*

Work on the new ships is proceeding slowly. Neither the République nor the Patrie have been commenced. The keel of the former will not be laid until after the launch of the Léon Gambetta, which is only just begun. When the keel of the Patrie will be laid is uncertain.

PROMOTION OF PETTY OFFICERS TO THE GRADE OF ENSIGN.—The French navy, like our own, is very short of officers. The personnel law of June 10, 1896, admitted chief petty officers, whose terms of service and professional knowledge conformed to certain requirements, to a school of instruction from which they were appointed ensigns. A modification

has recently been made by which certain petty officers of the next lower grade (to chief petty officers), whose services and acquirements are satisfactory, will also be eligible to appointment to the school of instruction.

FRENCH MANŒUVRES.—The French manœuvres have been attracting a good deal of attention during the week, and some of the incidents have been made known by the daily press. We cannot describe the operations at length, but certain points are deserving of special remark. It is, of course, plain that the operations were intended to represent the conditions of war with this country. The B squadron under command of Vice-Admiral Ménard, comprising the Masséna, Carnot. Amiral Baudin, Formidable, Hoche, and Courbet, with a light squadron of five vessels under Rear-Admiral Gourdon, was the French Northern Squadron from Brest, and was intended to represent our Channel Squadron seeking to effect a junction with the Mediterranean Squadron. This last in the French manœuvres, was represented by the C Squadron, under Rear-Admiral de la Noë, comprising the Charles Martel, Jauréguiberry, Lavoisier and Dunois, belonging to the French Mediterranean forces. The French squadron which was to attempt to prevent the junction of these forces was under command of Vice-Admiral de Maigret, and comprised the Gaulois, her two sisters, and the Brennus, with a light squadron under Rear-Admiral Caillard, comprising seven vessels. There was another squadron engaged, which represented the French Northern Squadron coming to the help of the French Mediterranean forces. This was under command of Rear-Admiral Mallarmé, and included the Bouvines, Tréhouart, and La Hire, with the collier Japon.

The system adopted was to give all these vessels a numerical value, and the squadrons were so accounted, that under Admiral de Maigret was worth 1,250, and that which was coming to join him 305. The force under Admiral Ménard, which represented our Channel Squadron, had a total value of 1,750, while that which stood in the place of our Mediterranean squadron was given a figure of 425. It is, of course, evident that these estimates were conventional and did not adequately represent, or endeavor to represent, the actual value of the forces that would have been actually engaged. It is possible that the French Admiralty was just as desirous to take account of a quarrel with the Triple Alliance, in which a German squadron might have come south to join hands with Italians, and perhaps Austrians, while the Russians were coming to the aid of their allies. One significant point appears to have been that Admiral Gervais, who was in supreme command, with his flag in the Bouvet, was empowered to join with either side in case it should appear that the manœuvres were likely to end without giving the lesson that had been expected.

In the result, those forces which represented our Channel and Mediterranean squadrons succeeded in effcting a junction, though not without sustaining some losses, and some of them reached Ajaccio, which may be taken to represent Malta, where an attempt to block them was made. If Admiral de Maigret had been able to defeat his two enemies severally before their junction, he would have triumphed, but, as soon as they were united, unless they had sustained severe losses, he would be in an inferior position. A high French authority is said to have asserted that the causes of his partial failure were well known, and could not recur in the case of actual war. The period of hostilities concluded on Tues-

day, and on Thursday morning the combined force entered Toulon, where a test was to be made of the capabilities of the port for coaling, provisioning, and repairing so large a fleet at short notice. Within an hour of the arrival 4,250 tons of coal had been taken on board the ships. The national fête will be celebrated, and the fleet will then engage in further evolutions.—*Army & Navy Gazette*, July 13.

SULLY LAUNCH.—The armored cruiser Sully, 10,014 tons, was launched at the yard of the Forges et Chantiers de la Mediterranée, La Seyne (near Toulon), on June 4. She is a sister ship in all respects to the Condé, fully described in PROCEEDINGS, *No. 97*, page 157.

DUPETIT THOUARS: LAUNCH DESCRIPTION.—This armored cruiser of the Montcalm class was launched at Mourillon arsenal, Toulon, July 5, 1901. She differs from her sisters in having Belleville boilers—the Gueydon having 28 Niclausse, and the Montcalm 4 Normand boilers and 8 of the double Normand-Sigaudy type. The hull is of steel without sheathing and specially subdivided in the vicinity of the water line. The free board is high at the bow and the upper deck extends from the stem to within 15 or 20 feet of the stern. As the decks have considerable sheer the stern is not very high above water. There is a military mast forward carrying a fighting top and a searchlight platform. The mainmast is intended chiefly for signalling but carries a small top placed rather low. The electric plant consists of four 400-ampère, 82-volt dynamos, driven by vertical compound engines at a speed of 350 revolutions. For interior lighting there are about 500 lamps. One searchlight is located on a platform at the head of the military mast, one on a platform low down on the main mast, and four are on the main deck—two forward and two aft—mounted on traveling railways, and rig in and out. Eighteen boats are carried. The full complement as a flagship is 610. The estimated cost of the ship complete is $3,961,665, of which $436,206 is for guns and $35,604 for torpedo armament. The principal details are:

Armament.—Two 7.6-inch guns in turrets on the upper deck, one forward, one aft, with arc of fire of 270 degrees. Eight 6.48-inch guns in armored sponsons on the main deck, four each side. The two forward guns can fire directly ahead and the two after ones directly astern. Each gun is enclosed in a casemate and each has a separate ammunition hoist actuated by electricity or by hand. Four 3.9-inch guns on the upper deck protected by shields: two over forward 6.48-inch guns and two nearly over the after 6.48-inch guns: each with a separate ammunition hoist. Sixteen 3-pounders: four in the military top; six on the upper deck and bridges; two on the main deck; and four on the berth deck. Six 1-pounders on the bridges and on the main deck aft. The 3-pounder and 1-pounder guns are served by three ammunition hoists, one in the military mast, one forward, and one aft. There are said to be four torpedo tubes, two of which are submerged.

Protection.—At the water line the main armor belt extends from the stem to within 13 feet of the stern, where a transverse bulkhead unites the ends. This belt rises 2.36 feet above, and descends 4.43 feet below water, except at the after end when the depth below water is only 2.36 feet. Its maximum thickness is 5.9 inches, decreasing to 3.54 inches forward and to 3.15 inches aft. Above the main belt a thinner belt extends over the same length and rises to the level of the upper armored deck, thus protecting the space between the two protective decks (the "tranche cellulaire"); its thickness is 3.74 inches amidships, decreasing

to 3.35 inches forward and 2.95 inches aft. There is still another belt above this which extends aft from the stem for a length of 141 feet to a point abreast the forward smokepipe and rises to the level of the main deck. It is 2.24 inches thick at the lower edge and 1.58 inches at the upper edge. The thwartship bulkhead forward of the forward casemates has armor 4.72 inches thick, and that abaft the after casemates is 3.94 inches thick. The transverse bulkhead which joins the after ends of the two side armor belts is 3.31 inches thick at the lower edge and 1.58 inches at the upper. The bulkheads at the ends of the casemates extend from the main deck to the upper deck and protect the 6.48-inch guns from raking fire; the bulkhead at the after ends of the belt extends downward from the main deck to the protective deck. The lower protective deck is of the usual turtle-back form and its slope descends to meet the lower edge of the main belt. It is 1.2 inches thick on the flat and 1.2 to 2.2 inches on the slopes. The upper protective deck is flat and rests on the upper belt. It is composed of one layer 0.4 inch thick except between the turrets, where it is composed of two layers of a total thickness of 0.63 inch. The conning tower on the forward bridge deck has 6.3-inch armor and a communication tube 4.7 inches thick.

Motive Power.—Triple-screw, vertical, 3-cylinder, triple-expansion engines, designed to develop 19,600 I. H. P. at 135 revolutions and give a speed of 21 knots. The engines are placed side by side in the same transverse space, but are separated by longitudinal watertight bulkheads. Steam is furnished by 28 Belleville boilers in four boiler compartments—two forward of and two abaft the engines and separated from each other and from the engine compartments by transverse bulkheads. The normal coal supply is 1020 tons; total capacity, 1600 tons. Provision is also made for carrying petroleum fuel in four cisterns—two forward, two aft—each holding 20 tons.

Dimensions.—Length, 459.2 feet; beam, 63.96 feet; draught, 24.6 feet; displacement, 9517 tons (metric).

Iéna: Final Trials.—The battleship Iéna has completed her trials. The full power trial took place July 16 with the following results: I. H. P., 16,500; revolutions, 126; speed, 18.2 knots; coal burned per square meter of grate area, 135 kilograms; coal burned per I. H. P. per hour, 0.779 kilogram. The machinery worked well in every respect. On July 9, preceding, she had a preliminary 6-hour trial with 20 boilers. The results were: I. H. P., 9000; speed, 16 knots, easily maintained.

Tage: Trials.—The protected cruiser Tage, 7345 tons, has completed her trials satisfactorily. She was launched in 1886 and has recently been refitted, receiving new engines and boilers. Her first trials after refitting were unsatisfactory owing to accidents to the machinery.

Davout: Trials.—The protected cruiser Davout has also been extensively repaired, receiving new machinery and Niclausse boilers. The trials, after completion of the repairs, are reported as satisfactory.

Libellule: Building.—The small torpedo boat Libellule is building at the Graville yard of the Forges et Chantiers de la Mediterranée, Havre. The dimensions are: Length, 118.1 feet; beam, 10.8 feet; displacement, 40 tons. The motive power consists of a turbine engine driving a single shaft carrying three screws. The boiler is of a new type designed by M. Rénard. The machinery is of 900 I. H. P. The screws project well astern and the rudder is forward of them and above the shaft. There are two smokepipes, oval in shape and side by side. Pe-

troleum fuel will be used either wholly or in part. The speed is expected to be about 35 knots. A single torpedo tube is carried on the stern.

BOMBARDE, CATAPULTE: ORDERED.—These torpedo-boat destroyers, of the same general type as the Arquebuse, Arbalète. etc., have been ordered of Messrs. A. Normand et Cie., Havre.

TORPEDO BOATS ORDERED.—Nos. 267 and 270 have been ordered of Messrs. A. Normand et Cie., Havre; Nos. 273 and 274, of Dyle & Bacalan, Bordeaux (contract time, 18 and 19 months); Nos. 275 and 276, of the Ateliers de la Gironde, Bordeaux (contract time, 16 and 18 months).

RAPIÈRE: LAUNCH.—The torpedo-boat destroyer Rapière, 303 tons, was launched at the arsenal, Rochefort, July 16. She is a sister boat in all respects to the Pertuisane and Escopette described in PROCEEDINGS *No.* 97, page 157.

TYPHON: LAUNCH, DESCRIPTION.—This torpedo boat was launched at the Graville yard of the Société des Forges et Chantiers de la Méditerranée, Havre, June 15. She is a sister to the Siroco, Mistral, and Simoun, but possibly differs from the Siroco and Mistral slightly in dimensions. The particulars of the Typhon and Simoun are: Length, 147.6 feet; beam, 16.7 feet; displacement, 185 tons. The armament consists of two torpedo tubes and two 3-pounders. The sides abreast the machinery spaces and the sloping parts of the deck over them are armored with nickel-steel plates 0.95 inch in thickness; the flat parts of the deck having plates of about half this thickness. The engines are twin-screw, designed to develop 4200 I. H. P. and give a speed of 26 knots.

TRAMONTANE: LAUNCH.—This torpedo boat was launched at Bordeaux (Ateliers de la Gironde?), May 21. She is a sister boat to the Borée which is undergoing trials. The dimensions are: Length, 147.6 feet; beam, 15.68 feet; displacement, 161 tons. The armament consists of two torpedo tubes and two 3-pounders. The engines are twin-screw, designed to develop 4400 I. H. P. and give a speed of 29 to 30 knots. Like the Typhon and others of her class, the Tramontane and Borée have thick nickel-steel plating over the boiler and engine rooms.

SIROCO: TRIALS.—The torpedo boat Siroco, 180 tons (see PROCEEDINGS *No. 98*, page 386), has completed her trials. She begun her progressive trials on June 24 and all went well up to 25 knots; then a crank pin became heated and the trial was stopped. On July 6, the state of the sea and a slight accident combined to interrupt the trial. But on July 11 the trials were completed with success. The speed on the measured base was 28.727 knots with 355 revolutions. The contract speed was 26 knots.

MISTRAL: TRIAL.—The Mistral, a sister boat in all respects to the Siroco, also completed her trials on July 11. The results were: Revolutions, 351; speed, 28.23 knots.

NEW SUBMARINE BOATS: GENERAL CHARACTERISTICS.—The Cherbourg correspondent of the *Yacht* says: "We learn that the new submarine boats already commenced, or to be commenced this year, will have a double motive power like the submergible boats; that is to say, a vapor, or gas engine, and electric accumulators. They will not be, however, submergible boats of the Narval and Sirène type, but true submarines in the proper sense of the word; only they will have a motor for propulsion when at the surface and for recharging the accumulators—the

latter being used only when submerged. In a word, they will realize up to a certain point the autonomous type of submarine boat. They will have a radius of action a little more extended than that of the purely submarine boat and will plunge more quickly than the Narval and Sirène, which are obliged to fill the ballast tanks between the hulls—a long operation as we know. The newer submarines, thanks to their small dimensions, will be easy to manoeuver. But one must not forget that, like all submarines, they are, above all, fair weather weapons, and particularly weapons for use during daylight. At night, in a calm—or nearly calm—sea, they can still operate; but, unlike the ordinary torpedo boat, they are not an arm whose most effective work is night attack."

In a later issue of the *Yacht* (July 6) the same correspondent says: "The submarine boat Morse will very soon make a descent and remain submerged for sixteen hours, in the course of which a tablet prepared by Dr. Gibrat will be tested. The tablet will be applied to the lips and nostrils in order to prevent the inhalation of toxic gases with which the air of submarine boats is charged. We learn that a submarine boat of a new type designed by M. Romazotti, the designer of the Morse, will be built at Cherbourg. It will be an experimental boat, costing 499,400 francs. and will differ notably from the other little vessels of this sort which are to be built in our port. These last will cost 365,400 francs each and there will be seven of them. They will have a displacement of 68 tons only, a length of 23.5 meters (77.1 feet), and a beam of 2.26 meters (7.4 feet). The only motive power will be electricity supplied by accumulators. Four of them have already been named—the Naïade, Protée, Lynx, Ludion."

TRITON: LAUNCH.—The submergible boat Triton, of the Narval type, and a sister to the Sirène, Silure, and Espadon, was launched at the arsenal, Cherbourg, July 13, 1901. For description, see PROCEEDINGS *No. 98*, page 387.

NARVAL: SEA TRIALS.—The submergible boat Narval has recently completed a 40-hour sea trial. In an article by M. Marc Landry in the *Moniteur de la Flotte*, comparing the Holland and the Narval, the trial is thus described:

"In obedience to orders of the Minister of Marine the Narval was subjected to a trial of endurance of forty hours. It left Cherbourg at one o'clock on the afternoon of May 22, with an ample supply of provisions, escorted by the seagoing torpedo boat Zouave, and was to return to Cherbourg on the morning of May 24. The sea being very rough on account of a strong wind from the northeast, the Narval ran into St. Malo at five o'clock on the morning of the 24th. This was the only variation from the established program.

"Our first submergible boat has thus navigated for forty hours without a single stop, covering a distance of 260 miles at a mean speed of 6.5 knots in a heavy sea. During this trip it made a plunge of several hours and twice recharged its accumulators while under way.

"On the 25th of May, the Narval left St. Malo without having taken on more provisions, petroleum, or stores. It proceeded directly to Cherbourg, and, on arriving, fired one of the four torpedoes carried. This firing showed that the adjustments of torpedoes remaining in the firing tube for five hours is not in the least disturbed.

"In order to be entirely truthful, it is proper to add that while the Narval had not a single accident during the forty hours trial, it had,

on the return from St. Malo, an accident to the pump. In order not to delay the arrival, the Narval was towed by the Zouave for three hours. Off La Hague the tow line was cast off and the boat proceeded to Cherbourg unassisted. This was the only incident of the trip."

The conditions under which this test was made were favorable toward bringing out the Narval's strong points. She is doubtless a success as a surface-cruising boat and is habitable when in this condition. Her great—one may say fatal—defect is the slowness of her submergence. If she be ever sighted by an enemy's cruiser, battleship, or desroyer, her doom is sealed. Under the most favorable conditions it takes fifteen minutes for submergence—and longer if attempting to go ahead. A destroyer can run six or seven miles in fifteen minutes and a cruiser or battleship at least four miles. The Narval could, therefore, never approach within striking distance of an enemy without reasonable certainty of being destroyed, unless she operates as a submarine.

NARVAL: EFFECT ON CREW OF 12 HOURS SUBMERGENCE.—"Considerable attention has been drawn to the effect produced upon the crew of the Narval during prolonged submersion. It was, therefore, determined to make a trial in which the boat should remain for twelve hours under water. This was arranged owing to disquieting facts noticed during recent experiments, it being found that the crew experienced what are described as grave sensations of fatigue and uneasiness. Up to that time the trials had been of comparatively brief duration, and no one doubted that longer periods would cause no trouble. A trial has lately been made, Dr. Gibrat, a medical officer of the French Navy, being in the boat. It is said to have been proved conclusively that the strain was far too much for the men. The close confinement and the want of fresh air produced nausea and exhaustion, and the men are said to have been completely unnerved. The reports will, doubtless, be carefully investigated. They have probably been exaggerated. Otherwise the boat has given satisfactory results. In the recent trials she covered 260 miles between Cherbourg and St. Malo in forty hours, and 90 miles on the return, making in all 350 miles, of which she was towed thirty under water, and the accumulators were charged twice during surface steaming. On arriving at Cherbourg the petroleum was not exhausted, and firing the torpedoes showed that the tubes had received no damage.—*Army and Navy Gazette.*

MORSE: FAILURE OF ATTACK ON THE COCYTE.—During his inspection of the Defense Mobile of the coasts, Admiral Fournier directed the Morse to make an attempt to torpedo the Cocyte using, of course, a torpedo with exercise head. The Morse was able easily to approach the Cocyte without being seen; but a northeast breeze rendered the sea lumpy and she was unable to launch her torpedo. This confirms what we have previously said: That submarine boats can be sure of succeeding in their attack only when the sea is calm or nearly so. In circumstances less favorable, they may be successful but they cannot count on it in their present state of development."—Cherbourg correspondent of *Le Yacht.*

GUSTAVE ZÉDÉ: RECENT TRIALS.—If the particulars given of the operations of the Gustave Zédé were credited, she seemed to have achieved success. According to the correspondent of the *Journal* she left Toulon under the command of Lieut. Jobard, convoyed by the Utile, and arrived off Ajaccio at six o'clock in the morning, the tug having kept out of

sight. The Zédé was then submerged, except for the periscope, and to some extent it was possible to discern the positions of the ship at anchor in the harbor. Two hours later the cruisers and torpedo boats came out at full speed, and the Zédé, which was lying on the surface at the time, had to plunge to escape observation. An attack was then made upon the Charles Martel, which was said to have been torpedoed. The Zédé afterwards returned to Toulon. We do not know the real conditions of this attack, and the suggestion may be hazarded that the battleship was lying in position for the submarine to practice upon. If this be so the value of the trial will be considerably reduced. It would not, at any rate, be wise to attach at the present time too much importance to it. The correspondent of the *Temps* said that after discharging its torpedo, the Zédé had to rise, and was under fire at short range, which would inevitably have destroyed her. She sought to plunge, but almost ran upon the ram of the Jauréguiberry, and would have been cut in two but for the clever handling of the battleship. In regard to the question of habitability, it is confessed that there were difficulties, but the *Temps* believes that the crew came out into the open air from time to time while the vessel was floating on the surface."—*Army & Navy Gazette*, July 13.

Concerning this attempt the *Engineer* (London) says: "Very pretty are the stories now running round concerning the Gustave Zédé, the lieutenant in which should become a very Lord Charles Beresford. Very pretty, but some of them are imaginary, beyond doubt, while two little facts are mostly ignored. In the first place, the Jauréguiberry had to turn to avoid ramming the precious submarine; in the second, the descriptions, if at all correct, indicate that the submarine would have annihilated herself in the attack. Finally, there is little reason to suppose that the torpedo boats could not have got the fleet just as easily, and without loss, the night before. Or they might have watched, followed, and attacked the next night. The superfluity of the submarine is the point the enthusiasts so forget."

GERMANY.

BUDGET FOR 1901.—The Budget for 1901 amounts to 196,416,572 marks ($46,747,144.14; 1 mark = $0.238), a considerable increase on the budget of 1900, which only amounted to 152,741,132 marks ($36,352,389.42).

ORDINARY PERMANENT EXPENDITURE	Marks.
Ministry of Marine and Naval Cabinet	1,295,620
Naval General Staff	122,385
Observatories, coast watch-towers, &c.	318,995
Station superintendence	358,625
Law department	107,580
Chaplain's department and garrison schools	84,206
Pay of officers and men	17,940,239
Maintenance of the fleet in commission	19,113,373
Allowances for officers and men	1,173,700
Clothing	319,791
Garrison administration and service	2,490,835
Allowance for quarters, etc.	1,359,109
Medical department	1,336,452
Traveling, transport, and freight charges	2,485,183
Training establishments	316,384

	Marks.
Maintenance of the fleet, dockyards, &c.	21,621,949
Ordnance and fortifications	7,268,505
Department of accountant-general	553,371
Pilotage and surveying	524,874
Miscellaneous expenses	992,120
Total of Naval Administration	79,783,296
Additional for Administration of Kiau Chau protectorate	48,126
Total of ordinary permanent estimates	79,831,422

SPECIAL ORDINARY ESTIMATES.

A. Shipbuilding.

For the construction of the first class battleship Kaiser Barbarossa (A), 4th and last instalment	2,750,000
For the Kaiser Karl der Grosse (B), 4th and last instalment	2,058,000
For the armored cruiser Prince Heinrich (A), 4th and last instalment	3,375,000
For the 1st class battleship Wittelsbach (C), 3d instalment	3,600,000
For the 1st class battleship Wettin (D), 3d instalment	6,000,000
For the 1st class battleship Zähringen (E), 3d instalment	6,000,000
For the 3d class cruiser Thetis (C), 3d and last instalment	1,140,000
For the 3d class cruiser Ariadne (D), 3d and last instalment	1,140,000
For the 1st class battleship F, 2d instalment	6,500,000
For the 1st class battleship G, 2d instalment	6,500,000
For the armored cruiser Prince Adalbert (B), 2d instalment	6,000,000
For the 3d class cruiser Medusa (E), 2d and last instalment	2,640,000
For the 3d class cruiser Amazone, 2d and last instalment	2,640,000
For the gunboat A, 2d and last instalment	1,000,000
For the 1st class battleship H, 1st instalment	3,000,000
For the 1st class battleship I, 1st instalment	3,000,000
For the armored cruiser to replace the Konig Wilhelm, 1st instalment	3,400,000
For the 3d class cruiser G, 1st instalment	1,300,000
For the 3d class cruiser H, 1st instalment	1,300,000
For the 3d class cruiser I, 1st instalment	1,300,000
For reconstruction of ships of Siegfried class	4,500,000
For a torpedo boat division, 1st instalment	2,400,000
For a torpedo boat division, 2d instalment	3,440,000
Total for Shipbuilding	74,983,000

B. Armament: Guns, mountings, etc.

For the battleship Kaiser Wilhelm der Grosse, 5th and last instalment	1,500,000
For the battleship Kaiser Barbarossa (A), and Kaiser Karl der Grosse (B), fourth instalment	3,800,000
For the armored cruiser Prinz Heinrich, 4th and last instalment	1,200,000
For the battleships Wittelsbach (C), Wettin (D), and Zähringen (E), 3d instalment	3,900,000
For the third class cruisers Thetis (C), and Ariadne (D), 3d and last instalment	400,000

	Marks.
For the battleships F, and G, 2d instalment	2,000,000
For the armored cruiser Prinz Adalbert (B), 2d instalment	2,100,000
For the third class criusers Medusa (E), and Amazone (F), 2d instalment	500,000
For the gunboat A, 2d and last instalment	290,000
For a torpedo boat division, 2d and last instalment	213,000
For the battleships H and I, 1st instalment	2,800,000
For the armored cruiser Ersatz Konig Wilhelm, 1st instalment	1,300,000
For the third class cruisers G, H, and I, 1st instalment	1,200,000
For a torpedo boat division, 1st instalment	210,000
For the improvement of the battery of ships of the Siegfried class, 1st instalment	500,000
Total for Guns, etc.	21,913,000
C. Torpedo Armament.	
For the battleships Kaiser Barbarossa (A), and Kaiser Karl der Grosse (B), 3d and last instalment	520,000
For the third class cruisers Thetis (C), and Ariadne (D), 3d and last instalment	220,000
For the battleships Wittelsbach (C), Wettin (D), and Zähringen (E), 2d instalment	900,000
For the third class cruisers Medussa (E), and Amazone (F), 2d instalment	280,000
For a torpedo boat division, 2d and last instalment	300,000
For the battlesnips F and G, 1st instalment	300,000
For the armored cruiser Prinz Adalbert, 1st instalment	240,000
For the armored cruiser Ersatz König Wilhelm, 1st instalment	100,000
For the third class cruisers G, H, and I, 1st instalment	120,000
For a torpedo boat division, 1st instalment	240,000
For the alteration of the torpedo armament of ships of the Siegfried class, 1st instalment	470,000
Total for torpedo armament	3,690,000
OTHER ITEMS	
Works in Navy Yards, etc.	14,699,150
Fortification works	1,300,000
RECAPITULATION.	
Ordinary permanent estimates	79,831,422
Shipbuilding	74,983,000
Guns, etc.	21,913,000
Torpedo armament	3,690,000
Work in Navy Yards	14,699,150
Fortification works	1,300,000
Total	196,416,572

—*Mittheilungen aus dem Gebiete des Seewesens.*

PERSONNEL.—According to the Rangliste of the German Navy, corrected to May 8, 1901, the numbers in the officers' lists are as follows, 2 admirals, 7 vice-admirals, 12 rear-admirals, 54 captains (capitäne

zur see), 22 commanders (fregatten capitäne), 86 lieutenant commanders (corvetten capitäne), 209 capitän-lieutnants first class, 324 capitän-lieutnants second class, 133 ober-lieutnants zur see, 424 lieutnants zur see and fähnriche zur see, and 211 see cadetten. Total executive officers, 1484. Officers of other corps, 539. Total of all lists, 2023. The increase for the current year includes 1 rear-admiral, 3 capitäne zur see, 9 fregatten capitäne and corvetten capitäne, 7 capitän-lieutnants of the first class and 5 of the second class, 24 ober-lieutnants zur see, 16 lieutnants zur see, 56 fähnriche zur see, and 45 See cadetten.

The Engineering branch consists of 1 chief engineer with the rank of commander, 3 senior staff engineers, 26 staff engineers, 55 engineers first class, and 86 engineers. The increase for the current year being 1 chief engineer, 4 staff engineers, 1 engineer first class, and 22 engineers. There are also 15 torpedo engineers attached to the dockyards and torpedo depots.

The Medical corps consists of 1 medical director-general (with the rank of rear-admiral), 2 inspectors-general, 7 fleet surgeons, 24 senior staff surgeons, 62 staff surgeons, and 80 surgeons and assistant surgeons; being an increase of 2 fleet surgeons, 5 senior staff surgeons, 4 staff surgeons, and 17 surgeons and assistant surgeons.

The Pay Corps consists of 13 staff paymasters, 61 senior paymasters, and 40 paymasters.

The Marine Corps officers are 1 major general, 2 lieutenant colonels, 6 majors, 31 captains, and 97 lieutenants, an increase for the year of 1 major general, 2 lieutenant colonels, 2 majors, 12 captains, and 44 lieutenants.

The seamen division consists of 62 chief warrant Officers, 98 warrant officers, 11,940 petty officers and men, and 1300 boys—a total of 13,400, showing an increase of 2 chief warrant officers, 7 warrant officers, 891 petty officers and men, and 300 boys.

The Dockyards division consists of 218 chief warrant officers, 434 warrant officers, and 7368 petty officers and men, of whom 563 chief and warrant officers, and 5872 petty officers and men form the engine-room personnel of the fleet, and of which there is an increase of 55 chief and warrant officers, and 660 petty officers and men, with a total increase in the division of 60 chief and warrant officers, and 805 petty officers and men.

The Torpedo division consists of 195 chief and warrant officers and 2962 petty officers and men, of which 40 chief and warrant officers and 1522 petty officers and men are of the seaman class, while 155 chief and warrant officers and 1440 petty officers and men are of the engineering branch. The increase in this division consists of 15 chief and warrant officers and 323 petty officers and men.

The Seaman artillery division consists of 28 chief and warrant officers and 2267 petty officers and men, an increase of 2 warrant officers and 95 petty officers and men.

The Marine infantry consists of 196 non-commissioned officers and 1038 men, an increase of 35 non-commissioned officers.

The total strength of the navy, including all branches, stands at 2134 officers and 28,904 warrant and petty officers and men, or a total of 31,038 officers and men, as compared with 28,204 officers and men in 1900, showing an increase of 2834 over last year.—*Journal of the Royal United Service Institution* and other sources.

ENGINEERING SCHOOL.—By order of the Emperor, a naval engineering school, for the instruction of officers in the higher grades, will be opened at Kiel on October 1. A senior naval officer will be placed in charge.

ARMY OFFICERS IN THE FLEET.—It is reported that 360 officers of the German army are to be embarked on vessels of the fleet for the purpose of acquiring some knowledge of ships from direct observation. They will be divided among the ships of the squadrons during the naval manoeuvers. This is an excellent idea. No army officer without a knowledge of the general characteristics of ships and the conditions under which they operate is competent to properly conduct operations on shore against the attack of ships.

COALING STATION IN THE RED SEA.—It is stated that the German Navy Department desires to establish a coaling station in the Red Sea, and that it has endeavored to obtain the session of the little archipelago of Farsan from Turkey. The Ottoman government was not willing to accede to this proposition, but has permitted the Germans to establish a station on the little island of Kouma, near Farsan, where they have constructed some buildings, under the surveillance of a Turkish functionary, conformably to instructions from the Porte.

THE GERMAN FLEET.—The matériel of the fleet, including ships under construction, is as follows:

Twenty-nine battleships; to be increased to thirty-eight in accordance with the Navy Act of 1900. Of these there are eight first-class battleships completed and eight in various stages of construction; five third-class battleships, and eight fourth class—the latter being rated as coast-defense ships.

Twelve first-class cruisers completed and building, which are to be increased to fourteen. Of these there are three armored cruisers, only one of which, the Fürst Bismarck, is a new ship, the other two being really only third-class battleships which are twenty-seven years old. There are three armored cruisers building; the other six first-class cruisers are of the protected cruiser class and five are quite new ships.

Thirty-two small cruisers, to be increased to thirty-eight. Of these, twenty-eight are completed and four are building. Six of the completed small cruisers are new and eight others are first-class gunboats, five of which are new.

There are fourteen school and training ships and six special-service vessels. Eighteen torpedo-boat destroyers; one hundred and nine first-class torpedo boats; thirty second class; and one torpedo-depot ship.—*Journal of the Royal United Service Institution.*

BATTLESHIPS H AND I: CONTRACTS AWARDED.—The contract for the construction of battleship "H," of the new program, has been awarded to the Germania Works at Kiel; and the contract for battleship "I" to Herr F. Schichau, Dantzic. They are to be completed in 1904.

PROTECTED CRUISERS G, H, AND I: CONTRACTS AWARDED.—The contracts for these vessels have been awarded as follows: "G" and "H" to the Howaldt Company, Kiel; and "I" to the Weser Company, Bremen. The contract time is two years, so that they are to be delivered in the spring of 1903. These vessels are similar to the Amazone, 2645 tons, which is described in PROCEEDINGS *No. 96*, page 703.

ARMORED CRUISER C: CONTRACT AWARDED.—The contract for the construction of armored cruiser "C," to be built to replace the Konig Wilhelm—and temporarily styled Ersatz-Konig Wilhelm—has been

awarded to Messrs. Blohm and Voss of Hamburg. The contract time is three years. She will probably be launched in the autumn of 1902 and completed in the spring of 1904.

WETTIN, ZÄHRINGEN: LAUNCH.—These two battleships, formerly known as "D" and "E," have been launched—the former at the yard of Herr F. Schichau, Dantzic, on June 6; and the latter at the Germania yard, Kiel, June 12. They are sister ships to the Wittelsbach (ex-"C"), described in PROCEEDINGS *No. 97*, page 160.

PRINZ ADALBERT: LAUNCH, DESCRIPTION.—This vessel, formerly known as armored cruiser "B" (in the budget as 'Large Cruiser "B"'), was launched at the government yard, Kiel, June 22. She is nearly a sister ship to the Prinz Heinrich, launched March 22, 1900, but differs in the battery and in some other particulars. The hull is of steel, without sheathing. There are two military masts, each carrying one top; and two smokepipes. The bow is high and the superstructure extends from the stem to a point just forward of the after turret. The complement is 528; or, as a flagship, 571. The principal details are:

Armament.—Four 8.27-inch Krupp guns in pairs in turrets forward and aft, the forward turret being on the superstructure (or upper) deck, and the after one on the main deck. These turrets are reported to be trained by hydraulic power. Ten 5.9-inch guns—three each side in a long casemate on the gun deck, forward pair firing directly ahead, and after pair directly astern; and four in four turrets, two each side, over the casemates for the 5.9-inch guns. The top sides are carried inboard to permit bow and stern fire from these turrets. Twelve 3.47-inch guns in the superstructure and on the upper deck and bridges. Four machine guns. Five submerged torpedo tubes: one through the keel, twenty or thirty feet abaft the point of the ram, and two each side. One above-water torpedo tube in the stern on the berth deck, protected by armor.

Protection.—Complete belt, 7.5 feet wide, 3.9 inches thick amidships, and 3.2 inches at the ends. Above this, and extending up to the gun deck for a length of 165 feet amidships, the side is covered with 3.9-inch armor; and above this again is the casemate armor of the 5.9-inch guns. The protective deck, behind the belt and sloping down at the sides to meet the lower edge of the latter, is 2.8 inches thick on the slopes and 1.6 inches on the flat. The flat armor deck over the upper side armor, outside the casemate, is 1.2 inches thick; and the deck over the casemates is 1.4 inches. The turrets for the 8.27-inch guns are 5.9 inches thick and rest on barbette towers of the same thickness. The forward tower only extends down to the main deck and the after one to the gun deck; thence loading tubes extend to the protective deck. The armor of the 5.9-inch turrets is 3.9 inches thick in front and 3.2 inches in rear, and of the 5.9-inch casemates, 3.9 inches. The forward conning tower is 5.9 inches thick, and the after one 0.47-inch of special steel. The loading tubes for the 8.27-inch guns are 3.9 to 3.2 inches thick; for the 5.9-inch turrets, 3.2 inches.

Motive Power.—Triple-screw, 4-cylinder, triple-expansion engines, designed to develop 16,000 I. H. P. and give a speed of 21 knots. Fourteen Dürr water-tube boilers. Coal supply, at load draught, 950 tons; total capacity, 1500 tons.

Dimensions.—Length, 393.7 feet; beam, 64.3 feet; mean draught, 24.3 feet; displacement, about 9000 tons.

HEIMDAL, HILDEBRAND, BEOWULF: RECONSTRUCTION.—The reconstruction of these vessels on the same lines as that of the Hagen (see PROCEEDINGS *No. 97*, page 162; also photograph of the Hagen as reconstructed, PROCEEDINGS *No. 98*, page 391) has been commenced. The Heimdal is rebuilding at the government yard, Kiel, and the others at the government yard, Dantzic.

TORPEDO BOAT S_{102}: LAUNCH.—This boat, the first of the division S_{102} to S_{107} to take the water, was launched at the works of Herr F. Schichau, Elbing, on April 18. It will be speedily followed by the others of the division.

TORPEDO BOATS G_{108} to G_{113}: BUILDING.—These boats, contracted for this year, are building at the Germania yard, Kiel. Like their immediate predecessors, they are of about 350 tons, and therefore belong to the "destroyer" class.

ARIADNE: BOILER ACCIDENT.—The third-class cruiser Ariadne, 2645 tons, while undergoing trials early in July had a boiler explosion which caused the death of two men and seriously injured four others. The boilers of the Ariadne are of the Schultze type.

GREAT BRITAIN.

PERSONNEL: PRESENT NUMBERS.—In a Parliamentary paper which has just been issued the following return is given of the number of commissioned officers, subordinate and warrant officers, petty officers, men and boys of the various branches of the Royal Navy, borne on April 1, 1900, excluding pensioners and reserves. A similar return of the numbers of the commissioned, warrant and non-commissioned officers and men of the Royal Marine Forces was also issued and is appended: Executive Branch.—Commissioned officers, 1892; subordinate and warrant officers, including masters' assistants and cadets, 1974 (no masters' assistants are included in this number, as officers of that rank are no longer borne in the navy); petty officers, 7070; men, 28,875; boys, 9411; total, 49,222. Engineer Branch.—Commissioned officers, 889; subordinate officers, *i. e.*, engineer students, 196; warrant officers, 69; chief and other engine-room artificers, 3051; stokers, petty officers, 4475; men, 17,279; total, 25,959. Other Branches.—Commissioned officers, 946; subordinate and warrant officers, *i. e.*, clerks, assistant clerks and carpenters, 347 (including 13 head schoolmasters); petty officers, 4947; men, 5727; kroomen, 518; boys, 380; total, 12,865. Royal Marines.—Commissioned officers, 443; warrant officers, 39; non-commissioned officers, 2179; men, 15,800; total, 18,461. Grand total, 106,507.—*Marine Engineer* (London).

As noted in PROCEEDINGS *No. 98*, page 390, the total number of officers, seamen, boys, coast guard, and marines proposed for the year 1901-1902 is 118,635, being an increase of 3745 on the numbers proposed for 1900-1901, divided as follows: 287 officers, 1150 seamen, 500 stokers, 398 miscellaneous, 310 artisans (including 100 electricians), 1000 marines, 100 apprentices (shipwrights and coopers). The total number of officers, seamen, boys, coast guard, and marines provided for in the budget for 1900-1901 was 114,890, excluding the reserves, but probably including retired officers, pensioners, etc.

AMMUNITION HOISTS: ELECTRIC HOISTS ORDERED.—Orders have been given by the Admiralty to instal electric ammunition hoists on battleships and cruisers for all guns mounted in casemates.

BOILERS FOR SHIPS BUILDING.—According to recent reports the Challenger, Cornwall, Hermes, and Queen are to have Babcock & Wilcox boilers; the Montagu, Belleville; the Berwick and Suffolk, Niclausse; the Encounter and Media, Dürr; and the Medusa, Yarrow.

KING EDWARD VII, DOMINION, COMMONWEALTH: PARTIAL DESCRIPTION.—These new battleships are to be of 16,500 tons displacement, 18,000 I. H. P., and 18 knots speed. The protection is to be similar to that of the London class. The main belt, rising from the edge of the protective deck to 9 (?) inches above water, extends from stem to stern, and is 9 inches thick amidships. Above this the side, amidships, has 8-inch armor up to the gun deck. The armament will consist of four 12-inch guns in turrets forward and aft. Four 9.2-inch guns on the main deck, in turrets similar to those of the Cressy, one over each corner of the 6-inch battery, forward pair firing directly ahead, and after pair directly astern. Ten 6-inch guns in a central battery on the gun deck, separated by 2-inch splinter bulkheads. The thickness of the barbette towers and turrets for the 12-inch guns is not reported; that of the 9.2-inch turrets and barbette towers will be 6 to 7 inches, and of the side covering the 6-inch battery, 7 inches. These vessels are very similar to the first design of the Virginia and Rhode Island, substituting one 9.2-inch gun for two 8-inch, and reducing the number of 6-inch to ten.

NEW ARMORED CRUISERS: PARTIAL DESCRIPTION.—These will be similar to the vessels of the Monmouth class. The displacement will be 9800 tons and the speed 23 knots. The principal point in which they differ from their predecessors of the "County" class is the substitution of a 7.5-inch gun for each pair of 6-inch pieces which are mounted on the midship line forward and aft.

NEW THIRD-CLASS CRUISERS.—The two third-class cruisers of the new program are to be of about 3000 tons displacement and will have a speed of 21.5 knots.

NEW TORPEDO-BOAT DESTROYERS.—The ten destroyers of the new program are to be stronger in construction than their predecessors, and they will carry a larger supply of coal than the present 30-knot boats, but they will have the same speed.

CORNWALLIS: LAUNCH.—This first-class battleship was launched at the yard of the Thames Iron Works, Shipbuilding & Engineering Company, Blackwall, July 17. She is a sister ship to the Russell, fully described and illustrated in PROCEEDINGS *No.* 97, page 167.

LEVIATHAN: LAUNCH, DESCRIPTION.—This armored cruiser, the third of the Drake class to take the water, was launched at the yard of Messrs. John Brown & Company, Clydebank, July 3. The hull is of steel without sheathing. The freeboard is high forward. The forecastle extends about to the second smokepipe, but the bulwarks of the upper deck continue aft to the after bridge deck (which is at the same level as the forecastle), and the superstructure thus formed ends just forward of the after 9.2-inch gun. There are two signal masts each carrying two signal yards and a light top in which is mounted a searchlight. There are four smokepipes on the fore and aft midship line. The complement is 900, and the principal details are:

Armament.—Two 9.2-inch guns mounted singly in gun-houses over shallow barbette towers forward and aft. Sixteen 6-inch, 45-caliber guns, eight each side in double-story casemates, the four forward guns firing directly ahead and the four after ones directly astern. Fourteen 12-pounder guns: four each side on the main deck amidships in the spaces between the 6-inch casemates; one each side in a recessed port

on the main deck very far forward, and one each side on the gun deck very far aft in a similar port. Three 3-pounders. Two submerged torpedo tubes.

Protection.—The main belt is about 14 feet wide and extends from about 5 feet below water to the gun deck, on which rest the lower casemates. The belt is 6 inches thick and extends from the after 6-inch casemate, where the ends are joined by a thwartship bulkhead, to the forward 6-inch casemate. From this point to the stem the belt is of the same width, but only 2 or 3 inches thick. This thin belt covers the ram for some little distance back from its point. The protective deck extends from stem to stern. In the wake of the belt it is behind the latter and rises at the side from the belt's lower edge. Its thickness on the slopes is 3 inches, and on the flat, 2 inches. The gun deck, resting on the top of the belt, is 1 inch thick. The barbette towers of the 9.2-inch guns are shallow, not even extending so far down as the main deck forward, or the gun deck aft. An armored loading tube extends from the barbette armor to the protective deck. The barbette towers are 6 inches thick and the gun-houses 5 inches. The casemates of the 6-inch guns are 5 inches thick in front and 2 inches in rear. The conning tower is 12 inches thick.

Motive Power.—Twin-screw, 4-cylinder, triple-expansion engines, with cylinders 43.5, 71, 81.5 and 81.5 inches in diameter and 48 inches stroke. Weight of propelling machinery, 2500 tons. Revolutions of engines, 120, and piston speed, 960 feet when working at full power. Boilers: 43 Belleville; heating surface, 71,970 square feet; grate area, 2310 square feet; working pressure, 250 to 300 pounds. Designed I. H. P. of machinery, 30,000; corresponding speed on 8-hour trial, 23 knots. The coal supply at load draught is 1250 tons; total capacity, 2500 tons.

Dimensions.—Length between perpendiculars, 500 feet; beam, 71 feet; mean draught, 26 feet; displacement at this draught, 14,100 tons.

TEAL: LAUNCH, TRIAL, DESCRIPTION.—This shallow-draught gunboat, a sister to the Moorhen, still on the ways, was launched at the yard of Messrs. Yarrow & Company, Poplar, May 18, 1901. The dimensions are: Length, 160 feet; beam, 24.5 feet; mean draught, 2.25 feet; displacement, about 180 tons. The hull is of galvanized steel and is divided into twelve separate, floatable sections. These may be launched separately and are then bolted together, which enables them to be put together without great loss of time or the necessity of having skilled labor. The main deck rises only 3 or 4 feet above the water. Above this there is a two-story central superstructure containing the quarters, upper part of machinery, etc. The conning tower and the sides of the hull are bullet-proof, as is the plating of the superstructure protecting the boilers and quarters. This superstructure plating is loop-holed for rifle firing. The magazines are placed below the main deck with a ammunition hoists leading through the quarters to several small guns mounted on the superstructure deck. The vessel is propelled by twin screws working in specially designed tunnels under the stern which cause the water to rise and cover the screws, the blades of the screws extending some distance above the water line. Steam is supplied by two Yarrow water-tube boilers. The stern is square, and, to insure quick manoeuvering power, there are four rudders. There is a fan in the fire-room for forced draught, but this was not used on the trial and is intended only for use with particularly bad fuel, such as green or wet wood. The official trial took place May 24 over the Admiralty measured mile course. The mean results of six runs were: steam at boilers, 150 pounds; vacuum, 25.75

inches; revolutions, 282.9; speed, 13.045 knots. After the six runs on the measured mile, a three-hour trial took place, the mean revolutions being 282.6, equivalent to 13.033 knots, or 15 statute miles per hour. During one hour, wood fuel only was used. Forced draught was not resorted to, the fan being turned over slowly for the sake of ventilation only.—Chiefly from the *Engineer* (London) and *Engineering* (London).

INDUSTRY: LAUNCH, DESCRIPTION.—This steamer, designed as a transport for carrying guns, ammunition, and other stores between the different dockyards, was launched at the yard of Messrs. William Beardmore & Company (late R. Napier & Sons), Govan (near Glasgow). She is fitted with extra large hatches and the most modern appliances for the efficient working of the ship and the handling of heavy cargo. The general dimensions are: Length, 205 feet; beam, 30.5 feet; depth, 18 feet; normal displacement, about 1640 tons. The engines are 3-cylinder, triple-expansion, driving a single screw, and have cylinders of 18, 28, and 44 inches diameter and 30 inches stroke. The boilers are cylindrical, two in number, and are designed for a working pressure of 155 pounds.

BULWARK: TRIALS.—The trials of this first-class battleship of 15,000 tons have been completed with the following results:

Character of Trial.	Date.	Duration of Trial, hours.	Boiler Pressure, pounds.	I. H. P.	Revolutions.	Speed, knots.
At ¼ power....	May 21	30	226	3,174	66	11.2
At ½ power....	" 24	30	256	11,755	101	16.8
At full power.	" 28	8	280	15,358	110	18.15

FORMIDABLE: TRIALS.—This first-class battleship of 15,000 tons is a sister ship in all respects to the Implacable which is fully described in PROCEEDINGS *No. 98*, page 393. She has completed her trials with the following results:

Character of Trial.	Date.	Duration of Trial, hours.	Boiler pressure, pounds.	I. H P.	Revolutions.	Speed, knots.	Air pressure, inches.
At ¼ power....	Mch. 27	30	233	3,262	.....	11.5	....
At ½ power....	June 8	30	257	11,618	101.0	16.81	....
At full power..	" 13	8	280	15,511	109.4	18.13*	0.18

* Mean of 6 runs over the measured mile.

The draught on the full power trial was 26.5 feet forward and 27.75 feet aft.

VENGEANCE: TRIALS.—This lightly armored battleship of 12,950 tons, sister ship to the Albion, Canopus, Glory, Goliath, and Ocean, has completed her trials with the following results:

	Average of 30 hours, June 25 and 26, 1901.	Average of 30 hours, July 1 and 2, 1901.	Average of 8 hours, July 5 and 6, 1901.
Vacuum—port, inches..... .....26.7		25	26
" —starboard, inches.....26.5		25.5	26
Steam pressure in stokehold, lbs.....254		264.3	298
Steam pressure in engine room, lbs.....243		245.45	249
Revolutions—port, per minute.....65.88		102.12	110.5
Revolutions—starboard, per minute.....66.11		102.33	110.8
Total I. H. P. (collective).....2,885		10,387	13,852
Speed by patent log, knots 11.35		17.491	18.5
Number of boilers in use..... 8		20	20
Coal consumption per I. H. P., lbs..... 1.69		1.51	1.72

—*Engineering* (London).

ABOUKIR, SUTLEJ: TRIALS.—These first-class armored cruisers of 12,000 tons have completed their trials. They are in all essential respects sister ships to the Bacchante, which is fully described in PROCEEDINGS *No. 97*, page 168. The results of the trials are as follows:

Character of trial.	One-fifth power.		Four-fifths power.		Full power.	
Name of ship.....	Aboukir.	Sutlej.	Aboukir.	Sutlej.	Aboukir.	Sutlej.
Date of trial	April 30	April 21	May 3	April 19	May 7	May 9
Duration, hours	30	30	26	30	8	8
Boiler pressure, lbs..	280	....	248	248	285	280
Revolutions.....	74.5	75	114.3	113.5	123.2	122
I. H. P.....	4,591	4,679	16,274	16,604	21,352	21,261
Speed, knots	14.4	14.03	20.42	20.62	21.60	21.77
Coal per I. H. P., lbs.	1.9	....	1.77	1.9	1.84	2.3
Air pressure, inches.	nil	nil	nil	nil	0.27	0.5
Mean draught, feet..	26.25	26.25	26.25	26.25	26.25	26.25

—*Rivista Marittima, Journal of Royal United Service Institution*, etc.

PANDORA: TRIAL.—The full power trials of this third class cruiser of 2200 tons have been delayed for four months by leaky joints in her steam piping. On June 5, after being fitted with new screws, she had a successful full power trial with the following results: steam at boilers, 254 pounds; I. H. P., 7330; revolutions, 245; mean speed, 19.72 knots; coal consumed per I. H. P. per hour, 2.49 pounds.

VIPER: LOST.—On August 3, while taking part in the naval manoeuvers, and while running through fog at a speed stated to be 35 knots, the turbine-propelled torpedo-boat destroyer Viper ran ashore on the coast of Alderney. The bottom was knocked out of her, and she broke in half, becoming a total wreck.—*Engineer* (London), August 9.

RACEHORSE: ATTEMPTED TRIAL.—The trials of the torpedo-boat destroyer Racehorse have been interrupted by defects in the machinery.

EXPRESS UNSATISFACTORY TRIALS.—The torpedo-boat destroyer Express has recently attempted her fourth unsatisfactory trial. It was abandoned before completion on account of an accident to one of the intermediate cylinders. However, had the accident not occurred the trial would not have been satisfactory as the speed at no time approached the contract speed of 33 knots.

SPRIGHTLY: TRIAL.—On Wednesday, May 22, the torpedo-boat destroyer Sprightly carried out her official 30-knot coal consumption trial with successful results, obtaining 30.2 knots as the mean of six runs over the measured mile. The mean speed during three hours continuous steaming was 30.03 knots.—*Engineer* (London).

TORPEDO BOAT NO. 107: LAUNCH.—This boat, one of the two new ones described in PROCEEDINGS *No. 97*, page 170, was launched at the works of Messrs. J. I. Thorneycroft & Company, Chiswick, July 2.

TORPEDO BOAT NO. 99: TRIAL.—This torpedo boat, described in PROCEEDINGS *No. 97*, page 170, commenced her trials on May 25. The load carried on the trial was 42 tons and the speed attained, 25.06 knots. The contract requirement was 25 knots.

DARING: ACCIDENT.—An explosion took place in one of the boilers of the torpedo-boat destroyer Daring on June 10 causing the death of one man and seriously injuring four others, one of whom has since died. The Daring is one of the first destroyers built. Her displacement is 260 tons, designed speed 27 knots, I. H. P., 4200, and was fitted with Thorneycroft boilers which have been in service since her completion in 1894. The inquiry into the accident has shown that the opening

occurred in the lower tubes and let escape a flood of water and steam. Immediately after the accident a fire broke out, but it was rapidly extinguished.—*Le Yacht.*

TORPEDO BOAT NO. 81: SUNK.—Telegraphic dispatches in the daily papers state that torpedo boat No 81, taking part in the manoeuvers, was sunk off the Island of Alderney. She struck the submerged ruin of the old breakwater, managed to reach the inner harbor and sank there. The guns and stores have been removed and she will be raised.

SHIPS IN RESERVE: CLASSIFICATION.—The ships in reserve are divided into five categories, as follows:

A. All ships which can be made ready for active service in 48 hours.

B. Ships which can be repaired and made ready for service in 30 days or less. Crews and equipments on board or ready to go aboard.

C. Ships which require more than 30 days to prepare for service. Crew not organized. Equipment not ready for putting on board. As soon as ships in this category are in such a condition of repair that they can be made ready in 30 days they are transferred to category B.

D. Dockyard Reserve.—Ships which need extensive repairs. No equipments on board.

E. All ships which do not appear to be capable of being put in condition to render active service with the fleet.—*Le Yacht.*

GREECE.

The government has decided to appropriate annually the sum of 2,500,000 drachmas (1 drachma = $0.193) for the purpose of improving and building up the fleet. It has also requested the French government to lend the services of a naval constructor who will be given charge of the program of construction.

ITALY.

BUDGET PROPOSALS FOR THE FINANCIAL YEAR 1901-1902.—The budget as submitted to the Italian Parliament is as follows:

I. ORDINARY EXPENDITURE.

Administrative Expenses:	Lire.
Ministry, personnel	970,000
Ministry, office expenses	63,300
Superior Council, staff, controller's office	64,000
Postal and telegraphic expenses	20,000
Printing, etc.	98,000
Small incidental expenses	700
Legal expenses	2,000
Counsellors and other cabinet expenses	4,000
Repairs	76,000
Unforeseen expenses	20,000
Total	1,318,000
Pensions, etc.:	
Pensions	5,395,000
Transportation	30,000
Total	5,425,000

Merchant Marine:	Lire.
aptain of port	1,098,074
epairs to sailors' hospitals, etc	57,000
ent for captains of port	17,000
ıcidental expenses	120,000
ıstitute for merchant marine	218,572
xpenses of shipwrecks	30,000
uilding and navigation premiums for steamers and sailing ships in accordance with law of July 23, 1896	10,000,000
Total	11,540,646
Expenditure for the Navy:	
Ships under construction, in reserve, under repair, etc	6,079,000
Executive officers	3,432,000
Marine engineers and machinists	1,340,000
Naval commissary corps	898,000
Surgeons department	671,410
Pay of men	12,500,000
Premiums for service and additions to pay of men	1,690,700
Aid department	100,000
Technical civil personnel	1,349,400
Bookkeepers, clerks, day laborers, and storehouse watchmen	1,445,000
Royal police	305,800
Semaphore and carrier pigeon services	410,000
Personnel of local defense stations	325,000
Food supplies for ships and shore stations	8,100,000
Barracks, quarters, watchmen, and lighting	208,000
Care of sick and hospital material	481,364
Gifts and gratuities	12,000
Coal and other fuel for ships	5,500,000
Materials for construction and repairs of ships, etc	1,700,000
Personnel for construction and fortification works for the navy	111,500
Marine (Naval) Institute	408,000
Free scholarships to the naval academy and engineering school	149,483
Hydrographic service, *personnel*	37,112
Hydrographic service, *matériel*	255,000
Counsel fees	32,000
Travel on duty and missions	500,000
Transportation of material and supplies	125,000
Repairs of ships	7,360,000
Labor for repairs of ships	5,790,000
Artillery and armament, *matériel*	7,100,000
Labor expenses for repair of artillery and war material	2,223,025
Repairing and improving buildings, fortifications, etc	2,253,600
Shipbuilding: For the construction of the battleships Benedetto Brin and Regina Margherita at Castellamare and Spezia; of the armored cruiser Francesco Ferruccio at Venice; for several torpedo vessels, local defence ships, steamers, navy-yard vessels, etc.; for commencing battleships of the first class; for reconstruction of the battleship Italia; and for the construction or purchase of colliers	24,000,000
Total	96,892,394

II. EXTRAORDINARY EXPENDITURE.

General Expenses:	Lire.
Care and expenses of reserve ships, etc.	38,000
Expenses of officers and employés for extraordinary works	36,540
Total	74,540
Expenditure for the Navy:	
Ships under construction except those already mentioned	400,000
Coast defences	200,000
Fortification and armament of Maddalena	200,000
Torpedo purchases	500,000
Total	1,300,000
Miscellaneous:	
Equipment for ships in commission	3,500,000.00
Care of crown property given for marine purposes	2,664,125.85
Total	6,164,125.85

RECAPITULATION.

Administrative expenses	1,318,000.00
Pensions, etc.	5,425,000.00
Merchant Marine	11,540,646.00
Expenditure for the navy	96,892,394.00
Total of ordinary expenditure	115,176,040.00
General expenses	74,540.00
Expenditure for the navy	1,300,000.00
Miscellaneous	6,164,125.85
Total of extraordinary expenditure	7,538.665.85
Total of ordinary expenditure	115,176,040.00
Total amount of budget	122,714,705.85

(1 lira = $0.193)

These figures are derived from the *Mittheilungen aus dem Gebiete des Seewesens*, and is supposed to be a translation of the official Italian state paper "*Stato di previsione della spesa del ministero della marina.*" There are certain errors in the original footings of the columns which lead to the belief that an item of 1850 lire was omitted in "Administrative expenses"; and an item of 100,000 lire omitted in the "Expenditure for the navy;" or that items are in error to the extent of these amounts. Head 9, under "Administrative expenses," is missing. This may explain the 1850 lire. The total as given by the *Mittheilungen* is 122,816,555.85 lire. This is probably correct. The number of men provided for in the budget is 25,000, an increase of 500. Of the expenditure for fuel, 300,000 lire are for liquid fuel, 2,000,000 for 40,000 tons of coal for ships in foreign ports, and 2,736,000 lire for 76,000 tons of coal for ships in home waters.

REGINA MARGHERITA: LAUNCH, DESCRIPTION.—This first-class battleship, a sister to the Benedetto Brin, which is building at Castellamare, was launched at the Arsenal, Spezia, May 30, 1901. The keel was laid November 20, 1898. The hull is of steel without sheathing. The freeboard is of good height forward and aft. There is a central superstructure rising above the main deck amidships. There are two smokepipes and two military masts each carrying two tops and a signal topmast. The weights are as follows: Hull and equipment, 6195 tons; protection, 3155 tons; armament, including ammunition, etc., 1473 tons;

propelling machinery, 1603 tons; coal, 1000 tons; total, 13,426 tons. The complement is 625 men and 30 officers. The principal details are:

Armament.—Four 305-millimeter (12-inch) guns in turrets forward and aft. Four 203-millimeter (8-inch) guns in casemates on the main deck in the corners of the superstructure. Twelve 152-millimeter (6-inch) guns in an armored battery on the gun deck, each gun separated from its neighbor by a splinter bulkhead and the compartment containing each gun completed in rear by a continuous bulkhead running fore and aft. This is similar to the method of protection adopted for the lower battery of the Japanese battleship Mikasa and is a modification of the plan of the Kearsarge and Kentucky. The forward and after guns of the 6-inch battery are sponsoned out so that the forward ones fire directly ahead and the after ones directly astern. Sixteen 76-millimeter (3-inch) guns are mounted on the decks and bridges. Eight 3-pounders. Four torpedo tubes, two of which are submerged and the other two are on the forward berth deck behind armor.

Protection.—Complete armor belt, with a thickness of 5.9 inches for a length of about 262 feet, reduced to 3.15 inches at the ends. This belt extends 3.6 feet below water and rises 5.6 feet above it. Above the main belt, for a length of about 262 feet, and covering the side between the turrets, there is a second 5.9-inch belt rising to the gun deck. Above this again there is a 6-inch citadel containing the 6-inch guns arranged as already explained under the head of "Armament." The sides of the citadel are in line with the sides of the ship except where sponsoned out. At the ends, thwartship bulkheads extend inboard nearly at right angles to the ship's side and, if continued, would cross the ship just abaft the forward turret and forward of the after one. But after extending inboard for about one-fourth the beam, they turn squarely forward and aft and are then swept around the bases of the 12-inch turrets. Above the level of the main deck the armor of the turret base is circular in section. The protective deck is of the usual turtle-back form and rises from the lower edge of the belt. It is 3.15 inches in maximum thickness and 1.6 inches in minimum. The deck over the second belt, where it extends forward and aft beyond the citadel of the 6-inch guns, is also armored. The bulkheads at the ends of the second belt are 10 inches thick. The barbette towers of the 12-inch guns are 7.8 inches. The turrets are probably 7.8 inches in front and 5.9 inches on the sides. The casemates of the 8-inch and 6-inch guns are 5.9 inches. There are two conning towers, one forward and one aft, each 5.9 inches.

Motive Power.—The engines are twin-screw, 4-cylinder, triple-expansion, designed to develop 19,000 I. H. P. and give a speed of 20.5 knots. The cylinders are 37, 60.2, 69.3, and 69.3 inches in diameter with a stroke of 47.2 inches. Steam is supplied by 28 Niclausse boilers with a grate area of 144 square meters and a heating surface of 4674 square meters. The air pressure allowed on the forced draught trials is fixed at 0.4 inch. The anticipated I. H. P. with natural draught is 16,000 and the speed 19 knots. The coal supply at load draught is 1000 tons and the total capacity about 2000 tons.

Dimensions.—Length between perpendiculars, 426.5 feet; beam, 78.2 feet; mean draught, 27.1 feet; displacement at this draught, 13,526 tons (metric).

AMMIRAGLIO DI ST. BON: FORCED DRAUGHT TRIAL.—On the last forced draught trial this battleship attained a mean speed of 18.5 knots

with 14,277 I. H. P. The description of vessels of this class is given in PROCEEDINGS *No. 98*, page 398. The armament there given is incorrect, the eight 4.7-inch guns which these vessels carry being omitted, and the 1-pounders given as 19 instead of 10. The eight 4.7-inch guns are mounted behind shields on the upper decks and bridges very nearly over the 6-inch guns.

NEMBO: LAUNCH, DESCRIPTION.—This torpedo-boat destroyer was launched at the works of Messrs. C. & T. T. Pattison, Naples, on the 18th of May. She is built on plans furnished by Thorneycroft & Company and is one of four sister boats building at the Pattison yard, the names of the others being Aquilone, Borea, and Turbine. The hull is of steel plates, galvanized (*i. e.*, zinc-coated), and is divided into eleven water-tight compartments as follows: Beginning forward, the first is the collision department, containing water tanks and chain lockers; second, forward crew compartment; third, compartment for firemen; fourth, forward boiler compartment; fifth, after boiler compartment; sixth, engine compartment; seventh, petty officers' quarters and dynamo room; eighth, officers' quarters; ninth, machinists'; tenth, after crew compartment; eleventh, storeroom for provisions. The magazines and torpedo storerooms are in the lower parts of some of the compartments mentioned.

Armament.—One 3-inch gun on a platform above the conning tower with an arc of fire of 300 degrees. Five 6-pounders: one aft, two each side. Two torpedo tubes on central pivot mounts with arcs of train of about 90 degrees on each side.

Motive Power.—Twin-screw, 4-cylinder, triple-expansion engines, designed to develop 6000 I. H. P. and give a speed of 30 knots. Three Thorneycroft water-tube boilers, furnishing steam at 213 pounds per square inch. Coal capacity, 80 tons.

Dimensions.—Length between perpendiculars, 208 feet; beam, 19.6 feet; draught at full load, 6.33 feet forward and 7.5 feet aft; displacement, corresponding, 330 tons (metric).

SUBMARINE BOATS: RUMOR OF ORDER FOR TWENTY.—The Italian government, it is stated, has ordered twenty submarine boats of a type not stated. Colonel Cuniberti, the chief naval architect, is said to be a partisan of submarines, and so to some extent is the present Minister of Marine. Admiral Bettolo, on the other hand, who represents the chief part of Italian naval sentiment, is opposed to them root and branch. As he was till recently Minister of Marine, and is likely ere long to be so again, the course of Italy with regard to submarines promises to be interesting.—*Engineer* (London).

It is altogether unlikely that Italy has ordered so many boats. Her budgetary difficulties preclude such a course.

NETHERLANDS.

RINDJANI: TRIAL, DIMENSIONS, ETC.—This torpedo boat, a sister to the Orphir and Pangrango, was launched at the yard of Messrs. Yarrow & Company, Poplar, July 2, 1901, with steam up, and thirty-five minutes after launching she left the yard to undergo her trials. The mean results of six runs over the measured mile were: steam at boilers, 200 pounds; steam at engines, 186.6 pounds; vacuum, 23 inches; speed, 25.59 knots; slip, 12.1 per cent. After coming off the course the boat ran for some time at the measured mile speed. The dimensions of these boats are:

Length, 152.5 feet; beam, 15.25 feet; mean draught, 4.25 feet; displacement, 140 tons. The machinery is twin-screw, triple-expansion, and the contract speed requirement was 25 knots.

PORTUGAL.

RAINHA DONNA AMELIA: TRIALS, DESCRIPTION.—This small cruiser, built at Lisbon on the plans of M. Croneau, the French naval architect, has completed a series of trials satisfactorily. With natural draught, the results on a five-hour trial were: boiler pressure, 161 pounds; I. H. P., 3088; revolutions, 170; speed, 17.1 knots. During a run of twenty-four hours the speed was 15.75 knots with 162 revolutions. With forced draught during three hours the results were as follows: boiler pressure, 170.5 pounds; I. H. P., 5396; revolutions, 200; speed, 20.6 knots.

The armament of the ship consists of four 5.9-inch guns, two 3.9-inch, two 3-pounders, four machine guns, two torpedo tubes. The engines are twin-screw, triple-expansion, and the boilers are of the Normand water-tube type. The dimensions are: Length, 246 feet; beam, 36 feet; draught, 14.7 feet; displacement, 1660 tons. The hull is of steel without sheathing and the complement is 250.

RUSSIA.

GREAT FIRE AT GALERNAIA ISLAND SHIP YARD.—The great fire at the Galerny shipbuilding yard, St. Petersburg, on June 13, was a very serious affair, concerning which considerable secrecy has been observed. It broke out in the slip, built of wood, occupied by the first-class cruiser Vitiaz, in an early stage of construction, and in an incredibly short space of time slip and vessel became a roaring mass of flames. The fire brigades of the city were summoned, but before their arrival the adjoining workshops, the designers' office, and other offices were in flames. With the designers' office over 1000 valuable plans were burned, including, it is said, those of all the vessels building at St. Petersburg. The fury of the conflagration was such that the battleship Orel, building on an adjacent slip, was only saved with the greatest difficulty. She caught fire, but the flames were extinguished before they had done any great amount of damage. The first-class cruisers Pallada and Diana were also threatened, but were towed out into the middle of the river in time. Several lighters and other vessels, however, were consumed. While the cruisers were being removed, flaming splinters, carried across the River Fontanka by the wind, set fire to the immense navy provision stores, containing an enormous quantity of grain and other food stores, the bulk of which was soon destroyed, as well as a bridge across the Fontanka. The fire broke out about two in the afternoon, and at four it was raging over an area nearly two miles in circumference, and it was not until dark that all fears of a further extension of the conflagration were set at rest. The fire went on, however, until dawn, causing damage estimated at a total of about ten million roubles, including about a million for the Vitiaz, almost the only remaining trace of which is a deposit of about fourteen thousand hundredweight of molten steel. The most sensational reports are current as to the cause of the disaster, which is very widely believed to have been connected with the recent labor agitation. The belief in incendiarism is strengthened by the statements of various persons.—*Army & Navy Gazette.*

MATERIALS FOR SHIPBUILDING TO BE OF RUSSIAN MANUFACTURE. An ordnance, sanctioned by the Czar, has been promulgated by the Russian Minister of Marine, decreeing that all materials and articles used in the building of ships for the navy shall be exclusively of Russian origin and manufacture. Agents and representatives of foreign firms are to receive no orders in future, and in all contracts for the supply of shipbuilding materials it will be stipulated that they shall really be of Russian origin. It remains to be seen whether it will be possible to fulfil this condition.

CRONSTADT HARBOR IMPROVEMENTS.—During the coming summer the Imperial authorities intend to carry out a large scheme which has been drawn up with a view to deepening the harbor of Cronstadt. For this purpose the Ministry of Marine has ordered from the Scottish firm of Simons and Co., a steam dredger capable of working at a depth of 39½ ft.

SLAVA: ORDERED.—A new battleship about to be, or already commenced at the Baltic yard, St. Petersburg, is to be called the Slava (Glory). She is believed to be a sister ship to the Borodino, Orel, Imperator Alexander III, and Kniaz Suvarov, which were described in PROCEEDINGS *No.* 97, page 177.

ALMAZ: REMARKS.—The cruiser dispatch vessel, which appears in the table of "Ships Building" on page 177, PROCEEDINGS *No.* 97, and is referred to in the Russian budget on the same page, and in a note on page 180, is to be called the Almaz. She will be of the Novik type and will have a displacement of 3200 tons.

NEW CRUISER OF NOVIK TYPE ORDERED.—It is reported that the Russian government has placed an order with Herr F. Schichau, Dantzic, for another cruiser of the Novik type. The new vessel is to develop a mean speed of 25 knots on a 12-hour trial and is to carry six 4.7-inch guns in a citadel of 2-inch Krupp armor. She will, in addition, have eight 3-pounders, two Maxim machine guns, and six torpedo tubes.

KAGUL, OTSHAKOV: REMARKS.—These are the names given to the two new cruisers of the Bogatyr type, building on the Black Sea, the Kagul at Nicolaiev and the Otshakov at Sevastopol. These vessels are mentioned in the table of Russian "Ships Building" in PROCEEDINGS *No.* 97, page 177, also in the budget on the same page, and again in a note on page 180. The battery will be the same as that of the Bogatyr (see PROCEEDINGS *No.* 97, page 182), the I. H. P. of the machinery will be 19,500 and the speed 23 knots.

VITIAZ: DESTRUCTION, REMARKS.—This cruiser of the Bogatyr type was building at Galernaia Island, St. Petersburg. On June 13, she was totally destroyed in the great fire mentioned on a previous page. In the list of "Ships Building," given in PROCEEDINGS *No.* 97, page 177, she is noted as proposed.

IMPERATOR ALEXANDER III: LAUNCH.—This first-class battleship was launched August 4. She is a sister ship to the Borodino, fully described and illustrated in PROCEEDINGS *No.* 97, page 178. She was launched during a gale which blew down a flagstaff in the dockyard, killing an officer and a cadet and injuring the captain of the battleship and three cadets.

BOYARIN: LAUNCH, DESCRIPTION.—This protected cruiser is similar to the Novik, but has less speed. She is building at the yard of Messrs. Burmeister & Wain, Copenhagen, where she was launched June 8. She

has a raised forecastle and the upper deck is enclosed by a low rail to within about 75 feet of the stern. The details are not very definitely known. She was reported to have been launched last September and this error led the compiler to put her down as launched at that time in the list of Russian "Ships Building" which was published in PROCEEDINGS *No. 97*. The official and religious ceremony of affixing the silver plate to her keel, which is the Russian practice, probably led to the misconception, as I find that ceremony took place last September. Her principal details are:

Armament.—Six 4.7-inch guns: one forward on the forecastle; one aft on the main deck; two each side on the main deck amidships, but well apart. Eight 3-pounders: one each side on the after end of the forecastle; three each side on the main deck between the 4.7-inch guns. Two 1-pounders. Two machine guns. Five submerged torpedo tubes, of which one is in the bow and two are on each side.

Protection.—Complete protective deck and, perhaps, 2-inch side protection. Conning tower 3 inches thick on after end of forecastle.

Motive Power.—Twin-screw, triple-expansion engines, designed to develop 11,500 I. H. P. and give a speed of 22 to 23 knots. Sixteen Belleville boilers in three compartments. Three smokepipes. The coal supply is sufficient for 5000 miles at 11 knots.

Dimensions.—Length, 354 feet; beam, 42.6 feet; mean draught, 16.4 feet; displacement, about 3000 tons.

NEW TORPEDO BOATS.—The *Kronstadtski Viestnik* states that an order has been received by the Nevski Engineering Works, St. Petersburg, from the Russian Ministry of Marine to build five torpedo boats of the Tsiklon (Cyclone) type. The first two are to be ready by May, 1902, and each is to cost 240,000 roubles, or from 24,000l. to 36,000l., according to the rate at which the rouble is taken. The length of each boat will be 147 feet 7¾ inches; beam, 10 feet 2 inches; draught, 4 feet 9 inches; displacement, 150 tons; engines, 4200 indicated horse power, supplied by two Normand boilers having each 3211 square feet heating surface and 48.37 square feet grate area. Coal, and not oil, will be used; speed, 25 knots. Each boat will carry one torpedo tube on deck, and two 47-millimetre (1.85-inch) guns; and have a rudder fore and aft.—*Engineering* (London).

FORELLE, STERLIAD: TRIALS.—These torpedo-boat destroyers were described in PROCEEDINGS *No. 97*, page 184. The trials were "free route," like those of French destroyers, and consisted of a run of six hours, five of which at a speed of 22 knots, and one hour (neither the first nor the last) at full speed. The Forelle's trials, on April 30, gave: mean speed for five hours, 22.905 knots; full speed for one hour, 27.017 knots. The results of the Sterliad's trials, on May 3, were: mean speed for five hours, 22.546 knots; full speed for one hour, 27.381 knots. The weights carried on trial were about 75 tons.

NEW SUBMARINE BOAT.—A Russian engineer by the name of Kuteinikoff has built at Kronstadt a new electrically propelled submarine boat, designed by a lieutenant of the Russian navy, and of which the Russian government entertains great hopes.

COLLIER AND SCHOOL FOR FIREMEN.—The Russian government has ordered from the Germania Company, Kiel, a collier which is designed to serve as a school ship for firemen and machinists in addition to transporting coal, of which she will be able to carry about 4000 tons. She will

on previous designs. It is possible, in the first place, to establish for the auxiliary guns a uniform caliber and mounting instead of a heterogeneous battery composed of two different calibers each differently mounted. It is possible, in the second place, to mount the auxiliary guns single in broadside, gaining marked advantages as regards rapidity of fire and simplicity and ease of ammunition supply, and avoiding the numerous practical objections to the mounting of guns in turrets, which are generally recognized and were brought particularly to the attention of our officers who saw active service during the Spanish War."

The majority says that from a comparison of muzzle energy and weight of metal fired in a minute, its design is appreciably superior, and it has in addition many advantages which cannot be reduced to calculation which were powerful with the majority in causing them to reach their conclusions.

"The allegation has been made that by mounting an important portion of the battery in casemates a greater portion is thereby liable to be disabled by a single well-placed shot than if the guns are mounted in turrets as in the minority's plan. While this statement is generally admitted in principle, the majority claim that in this respect their design is fully equal to that of the minority when due consideration is given to the fact that the minority, by the use of the superposed turrets, exposes four guns to displacement by a single shot, and by the mounting of the twelve 6-inch guns in a single casemate renders them all liable to be placed out of action by a single large shell charged with high explosives. In this connection the majority desire to repeat what is indicated in the general statement of particulars, that there is a greater subdivision of the battery by armored protection than in the minority's plan.

"The majority claim a very important advantage over the minority's plan in providing for twelve 14-pounder guns, as against eight. In increasing the caliber and amount of the auxiliary battery of 8-inch and 6-inch guns the minority has seriously affected the efficiency of their ship by the very great reduction in the number of the secondary battery, which is enforced by the decrease of available positions owing to the great sweep of the turret guns. In proposing the 7-inch guns the majority call attention to the fact that the tendency abroad is to increase the thickness of casemate armor and of what may be termed the light armor, generally, to such a degree that it cannot be perforated at battle range by the 6-inch guns; hence the necessity of a more effective rapid-firing gun. The 7-inch, having the essential features of such a gun in its style of mounting, breech mechanism and energy, seems, therefore, a most appropriate weapon, and the latest information from abroad indicates a tendency on the part of other nations to follow in this direction, the British having developed a 7½-inch rapid-firing gun, and the Germans a 6.69-inch gun."

The minority in their report lay much stress upon the desirability of retaining the 8-inch gun on account of its popularity during the Spanish War, to which the majority reply that had the modern 6-inch or 7-inch gun then been in service it would have been found more efficient than were the 8-inch guns then in use. The new 7-inch weighs 13.3 tons, and the old 8-inch 13.1. The muzzle energy of the 7-inch is 9225 foot tons, and the muzzle energy of the old 8-inch is 7,498 foot tons, showing that the new 7-inch gun is a more powerful weapon than the 8-inch gun used during the Spanish War, and its type of mounting and breech mechanism gives it a decided advantage in ease of manipulation and in rapidity of fire. The majority in their report cite as an example of what a dis-

advantage guns in pairs in turrets are at, as compared with those not in turrets and independently mounted, the great excess of shots fired at the battle of Manila Bay by the Boston over those fired by the Olympia. The report says:

"Uniformity of caliber, simplicity of mounting, separation of guns, giving independent action to each, are features of great importance, to which the majority have given special attention in the preparation of their plan, which presents a vessels more powerful than any yet built or projected by any power. During the Spanish War there was a general condemnation of turrets as being detrimental to efficiency of gun service. The heat, lack of ventilation, contracted spaces and great difficulty of seeing the enemy were commented upon at great length by officers who served in turrets. The majority submit the following comparison by muzzle energy and weight of metal thrown in one minute, of the guns comprising the main batteries of the two plans under consideration, omitting the 12-inch guns, which are the same in both cases. Majority plan: twenty 7-inch guns—Broadside fire, 230,620 foot tons M. E. per minute from each broadside; broadside fire, 4125 pounds of metal per minute from each broadside. Minority plan: twelve 8-inch and twelve 6-inch guns—Broadside fire, 253,174 foot tons M. E. per minute, from one broadside only; broadside fire, 187,882 foot tons M. E. per minute from other broadside; broadside fire, 4,500 pounds metal per minute from one broadside only; broadside fire, 3,300 pounds metal per minute from other broadside. All main battery guns except 12-inch: Majority plan, 461,240 foot tons M. E. per minute; minority plan, 411,060 foot tons M. E. per minute; majority plan, 8250 pounds metal in one minute; minority plan, 7800 pounds metal in one minute.

"The minority lay much stress upon the strength of end fire as provided for in their plan, which the majority concede to be very heavy; but it may be remarked that as the chief strength of a modern battleship's battery is in its broadside and not in its end fire, there is every probability that naval battles will, in the future, as in the past be fought broadside to broadside, rather than end on. The minority plan gives 2 more guns for end fire than does the majority plan; that is it gives six 8-inch as against four 7-inch, but as the latter are proposed to be mounted separately, having independent action, the majority believe they will prove as efficient as the six 8-inch guns in three turrets proposed by the minority."

Designs for the New Armored Cruisers.—The chief of the Bureau of Construction and Repair is now preparing plans for two armored cruisers which will be authorized by Congress at its next session. According to the instructions issued by the Board on Construction, these cruisers will be superior to foreign vessels of their type, and, in fact, will be superior to any armored cruisers ever built for this or any other country. Either way the battleship controversy is finally settled the two battleships which will form part of the naval increase next session will be more formidable than any of their type contemplated by foreign governments. So the cruisers are to be more formidable than other vessels in their class. A few weeks ago Rear Admiral Bowles, the chief of the Bureau of Construction and Repair, presented to the board plans for a 11,000 ton armored cruiser. The main battery consisted of four 8-inch guns and a number of 6-inch guns. According to the plans an excellent distribution of weight was made, and they hence received the almost unanimous approval of the Board on Construction. Rear Admiral Bradford, however, objected to the plans, arguing that

as England and other maritime powers are building armored cruisers of 14,000 tons displacement, this country should build vessels superior, if anything, but certainly not inferior in any respect. His view was accepted by the whole board, and consequently Admiral Bowles was directed to have prepared plans for a larger ship. It is expected that the plans will describe vessels having these general characteristics: Length, 502 feet; beam, 49 feet 6 inches; draught, 24 feet 6 inches; displacement, not less than 14,000 tons. Armament, eight 8-inch guns in four turrets, two forward and aft on the keel line of the ship, and one in each beam in the waist of the ship; fourteen 6-inch guns, most of which will be in broadside, and a strong secondary battery not yet determined. It is barely possible that the 8-inch guns will be replaced by 7-inch guns of the rapid-firing type. The board is divided on this qestion. The speed of the cruisers will be 22 knots; they will have coil boilers, vertical triple-expansion engines and twin screws, and a coal capacity of 2000 tons. There seems to be a growing tendency among naval experts to build more battleships in the future than armored cruisers. It is claimed by many of the best known naval constructors that they are generally more efficient and useful than the armored cruisers. This matter will be discussed in the near future and will probably be a subject for a report to be made by the Board on Construction.—*Army and Navy Journal*, Aug. 3.

Torpedo Boat Stations, and Care and Preservation of Boats.—The board of naval officers, of which Captain Converse is the President, appointed to report on the best method of the care and preservation of torpedo boats, has submitted a long and comprehensive report to the Secretary of the Navy. The board recommends that general torpedo boat stations be established at Portsmouth Grove, Cedar Grove, Norfolk; Chicora Park, Charleston, South Carolina; and Pensacola, Fla., on the Atlantic coast; and at Mare Island, on the Pacific coast. In order to keep the boats in the best possible condition the board urgently recommends that they be kept in commission all the time. When not possible to do so, however, the little craft should be "in commission in reserve," with half their regular crew. At each of the general stations the board is in favor of the construction of a wet basin, into which the boats could be placed when necessary. Only in case of absolute necessity, the board reports, should the boats be hauled out of the water for any repair. They should only be sent to navy yards when the repairs cannot possibly be effected at the general stations. The board urges that crews for torpedo boats be specially selected, trained men, who are never to be used for other duty. In case additional torpedo boats are built for the Navy, the board is of the opinion that additional general stations should be established. The report goes into great detail as to the best method of handling the torpedo boats, as to painting, cleaning, etc. Such is the importance of the report that the Secretary of the Navy will order that it be printed for general distribution. The board estimates the cost of the wet basin at approximately $100,000.—*Army and Navy Journal.*

New Dry Docks.—Plans for the new dry dock at the New York Navy Yard, for which bids will soon be advertised, provide for a dock of thirty feet in depth to be built of stone masonry and have every facility for docking the largest ships. Plans have also been drawn for the construction of a stone masonry dock even larger than the New York dock, at the new naval station at Charleston.

The Navy Department has purchased the floating dry dock which lies

in Havana harbor, from the Government of Spain for $185,000. Negotiations for the purchase of the dock were closed by Comdr. Lucien Young, Captain of the Port, at Havana. The original price at which the dock was offered by the Spanish Government was $250,000. It is stated by the chief naval constructor that the dock has been in constant use. Secretary Long has under consideration a recommendation of Admiral Bowles that the dock be sent to the Philippines. Admiral Bowles regards this plan as feasible. The British Government sent one of the biggest dry docks in the world from England to Bermuda, and another from England to Port Mahon in the Mediterranean.—*Army and Navy Journal.*

IMPROVEMENTS AT NEW YORK NAVY YARD.—The Navy Department is at last moving in the matter of improving the cob dock at the New York Navy Yard, and also the Whitney Basin in the same yard. The proposed improvements comprise the removal of some 20,000 cubic yards of crib work from the cob dock and about 100,000 cubic yards of dredging from the basin. With these improvements the Wallabout channel of the yard will become one of the best basins in the yard, and will add greatly to the conveniences and areas of the station. The contracts for the work have not been assigned, but it is believed that they will go to local contractors.—*Army and Navy Journal.*

NAVAL STATION IN PORTO RICO.—Following the necessities of the Navy, an investigation is on foot for the determination of the best point for the inauguration of a Porto Rican naval station. A board of Naval officers will soon be appointed to proceed to that island and report upon the advisability of establishing a naval station there. Admiral Luce, during his recently concluded tour among the West Indies, made some investigation looking to this object, but the present inquiry will embrace a much wider scope than was attempted by Admiral Luce, and will include in its field not only a rendezvous for ships, but the establishment of a first class naval station at one of the eastern outposts of the Antilles. The commission will be assigned the use of the Mayflower for the objects of their inquiry. It is not contemplated that anything more than a beginning will be made at the present time, but the ultimate idea of the Department is to perfect the establishment of a naval station in that part of the world which shall enable the Navy Department to cut loose from the Atlantic coast dock yards in case of necessity, employing the facilities intended to be established at Porto Rico for this purpose. Surveys for naval stations in Cuba, conducted by the Eagle, the Yankton and the Vixen on most of the chief harbors are now completed. The most important points are probably Cape San Antonio and Cape Maysi. At Cape Maysi it has been found that there is a reef running far out into the water, and that there is no suitable harbor within about forty miles of the Cape. The Bay of Nipe appears to afford the most available harbor in that locality. Cape San Antonio has no harbor of any kind in its immediate vicinity suitable for a naval or coaling station. Most of the large harbors along the northern and southern coasts have been surveyed and charted, those of Cienfuegos and Guantanamo apparently being among the best on the southern coast.—*Army and Navy Journal.*

PENNSYLVANIA: KEEL LAID.—The keel of this armored cruiser was laid at the yard of the William Cramp Ship & Engine Building Company, Philadelphia, early in July. The Pennsylvania belongs to the California class of armored cruisers fully described in PROCEEDINGS *No. 96*, page 714. The name was originally assigned to a battleship.

MAINE: LAUNCH.—The first class battleship Maine was launched at the yard of the William Cramp Ship & Engine Building Company, Philadelphia, July 27, 1901. She is fully described and illustrated in PROCEEDINGS *No. 98*, page 403.

TRUXTON, WHIPPLE, WORDEN: LAUNCH, DESCRIPTION.—These three torpedo boat destroyers were all launched on August 15, at the yard of the Maryland Steel Company, Sparrow's Point, near Baltimore. These are much the largest torpedo boat destroyers built for any navy, as their normal displacement is 433 tons and their displacement at full load, with bunkers full and all stores on board, 610 tons. The keels of all three were laid Nov. 13, 1899, and the contract date of completion was April 4, 1900. The hull is of steel. The complement is 4 officers and 69 men. The principal details are:

Armament.—Two 3-inch guns; six 6-pounders; two 5-meter, 17.7-inch torpedo tubes.

Motive Power.—Twin-screw, vertical, triple-expansion engines designed to develop 8,300 I. H. P. and give a speed of 30 knots. Thorneycroft water-tube boilers. Normal coal supply 25 tons; total capacity 202 tons.

Dimensions.—Length on the water-line, 248 feet; beam, 23.25 feet; mean draught, 6 feet; normal displacement, 433 tons; gross tonnage, 541.02; full load displacement, 610 tons; tons per inch of immersion at normal draught, 9.5.

BIDDLE: TRIAL.—This torpedo boat of 167 tons displacement completed her trials July 2. The results were 306.7 revolutions and 28.57 knots. The Biddle is a sister boat to the Bagley described in PROCEEDINGS *No. 97*, page 189.

BAGLEY, BARNEY: TRIALS.—These two torpedo boats have completed their trials and have been provisionally accepted by the Navy Department. The Bagley developed a mean speed of 29.15 knots for two consecutive hours and the Barney a speed of 29.04 knots for the same length of time. They are sister boats in all respects and were built at the Bath Iron Works, Bath, Me. A description of the Bagley, which applies equally well to the Barney, is given in PROCEEDINGS *No. 97*, page 189.

WISCONSIN: FINAL COMMISSION TRIAL.—The following brief summary of the report of the Trial Board appeared in the *Army and Navy Journal*, of June 29: The Navy Department has received the official report of the final trial of the battleship Wisconsin. The report, which is dated San Francisco, June 21, 1901, speaks in the highest terms of praise of the qualities exhibited by the battleship during her recent trial. The average speed of the vessel for two hours under natural draught was 15.8 knots per hour. The total indicated horse power was 7,790. The main engines on the starboard side showed 3,783 horse power and those on the port side 3,857 horse power.

The board announces that all the unfinished work reported by the preliminary trial board has been completed in accordance with the requirements of the specifications with the exception of finally adjusting the power of the turret-turning motors of the forward turret. The few items on the work of changes reported uncompleted by the first board, and which are still uncompleted, the board attributes to the absence of the vessel from the Union Iron Works and to the subsequent labor troubles over which the contractors had no control. The uncompleted work in ordnance, as listed in the report of the preliminary board, has been satisfactorily completed, and there are no other defects of workmanship in the installation for which the contractors should be held

responsible. The speed requirements for supply of ammunition were not attained, but the deficiency was due to the handling force being insufficient and inexperienced; but the mechanical appliances are fully capable of handling ammunition at the required speed under proper conditions.

The board reports: "The battery of the vessel was sufficiently fired to prove to the board that the guns, gun carriages and their fittings and appurtenances work properly and the vessel is sufficiently strong to stand the shock caused by firing." The telephone system does not work, and is entirely inefficient as a means of interior communication. The tests of the search lights showed that they fell short by several thousand yards of the requirements of the Department. The board says, however, that the atmosphere was hazy at the time the tests were made.

In regard to the engineer department of the Wisconsin the board reports that the engines, boilers, appurtenances and spare parts are in conformity with the contract, drawings and specifications, except in a few minor matters, to which attention is called. "The condition of the boilers is not entirely satisfactory to the board. From the history of their service and from present appearance it is evident that the best of workmanship has not been secured in their building. Five of the eight boilers have had, and still have, numerous leaks at stay bolts in back connections, at furnace overlap seams, also in back connections and at ends of the lower main stays over furnaces, both front and back. The fact that the three remaining boilers have no such serious leaks, although performing the same duty, shows that the defect does not lie in the design, and the board is of the opinion that the faults are directly attributable to inferior workmanship at these points. The contractors should be required to go thoroughly over this work and place the boilers in a satisfactory condition as soon as possible."

NEWARK: RECONSTRUCTION.—Some $500,000 is to be expended in rebuilding the U. S. S. Newark. She is due shortly at the navy yard, Boston, Mass., from the Asiatic Station. She will be placed out of commission at Boston, where the repairs are to be made.—*Army and Navy Journal*, June 29.

PHILADELPHIA: REPAIRS, NEW BATTERY.—The Bureau of Ordnance has at last succeeded in inaugurating a reform in the main battery of the U. S. S. Philadelphia, and as soon as that vessel arrives at the Mare Island Navy Yard from the Mexican ports, en route from Acapulco, it is certain that she will have the long-delayed modifications in her battery carried out. The time required for this work has not been accurately estimated, but it is probable that several months will be spent by the vessel at the navy yard. Considerable machinery overhauling will also be carried out.—*Army and Navy Journal*, March 30, 1901.

PETREL: REPAIRS, ETC.—The U. S. S. Petrel will be surveyed as soon as she arrives at the Mare Island Navy Yard, and will go out of commission then for a thorough repairing and modification in several important particulars. The Petrel will return to the Asiatic Station as soon as her repairs are completed, but this will not be for several months yet. She was launched at Baltimore October 10, 1898, the contract price being $247,000.—*Army and Navy Journal*, July 6.

REINA MERCEDES: RECONSTRUCTION.—Acting under instructions from the Secretary of the Navy, the Bureau of Construction and Repair has prepared and forwarded a full set of plans for the rebuilding of the Reina Mercedes, but nothing definite has been arrived at in regard to the matter of rebuilding this vessel.—*Army and Navy Journal*, June 15.

RAINBOW AND SUPPLY: FITTED FOR STATION SHIPS.—The Rainbow and Supply, preparing for service at the navy yard, New York, will be ready for commission very shortly. Each has been fitted with commodious living quarters and will be comfortable ships for the officers assigned to them. The Rainbow will be the headquarters of the Philippines naval station. The flag officer assigned to permanent duty at Cavite will take up his residence in her. The Rainbow has twelve sets of water distillers installed on board and she can distill all the water for the fleet in the Philippines. The Supply will go to Guam, where she will be stationed as the flagship of the governor of the island.—*Army and Navy Journal*, July 20.

MARQUES DEL DUERO: REFLOATED.—On May 4, at Cavite, P. I., a large cheering crowd witnessed the towing of the resurrected Spanish gunboat, the Marques del Duero, from her bed on the bottom to the dry dock. The vessels in the bay dipped their flags and their sailors lined the shrouds and shouted their greeting. The raising of this vessel occurred on the morning of May 1, three years subsequent to Dewey's sinking of the Spanish fleet. The Marques del Duero lay the farthest in the bay of the sunken vessels, with the exception of one. She appeared to be in good condition, especially below water, where she had suffered but little. Her hull and machinery were in splendid shape.

The Duero was an 800-ton gunboat with twin screws and a light battery. She was built in France in 1887. Her guns were dismounted previous to her being raised. Contractor W. H. Hoffman, who is raising the wrecks, expects to have several other vessels soon placed alongside the Duero. "Operations are now proceeding on the Bulusan," said the Manila *Times* of May 8, "and work will shortly be begun on the Don Antonio de Ulloa."—*Army and Navy Journal*, June 29.

ADDER, MOCCASIN: LAUNCH, DESCRIPTION.—These two submarine boats have been launched, the Adder on July 22 and the Moccasin on August 20. They are the first to take the water of the five similar boats building at the yard of Mr. Lewis Nixon at Elizabethport, N. J. The others are the Plunger, Porpoise, and Shark; while two more of the same class, the Grampus and Pike, are building at the Union Iron Works, San Francisco. These boats have a so-called cigar-shaped body, pointed at both ends, but somewhat sharper aft. The hull is of steel of extra thickness and is braced by numerous frames. On top, nearly amidships, is the conning tower, 21 inches in inside diameter and protected by armor 4 inches thick. Immediately forward of this, also on the outside, is the steering binnacle, so placed as to be observed through a slit in the armor of the conning tower. Still further forward there is a large manhole or hatch, through which stores and torpedoes may be taken in. An external rib of varying height runs along the backbone of the hull and acts as a rolling chock, or keel, in addition to preventing lines or obstructions from catching on the projections above the hull. A large supply of compressed air is kept in cylinders, sufficient for about 24 hours continuous submergence. The boats, which normally run at the surface with quite a good deal of the upper part of the hulls exposed, are submerged by admitting water to the ballast tanks and they are then in the "awash" condition. The dive is then effected by means of diving rudders. Having thus a small amount of buoyancy the boats will rise to the surface if the machinery becomes disabled and stops. The complement is not yet assigned. The contract price is $170,000 each. The details of armament, motive power, and dimensions are:

Armament.—This consists of one torpedo expulsion tube in the bow. Five Whitehead torpedoes are carried, each 17.7 inches in diameter and 11.65 feet long.

Motive Power.—When running at the surface, a single-screw, 4-cylinder, Otto gasolene engine, designed to develop 160 I. H. P. and a speed of 8 knots. When awash or submerged, storage batteries drive an electric motor of 70 I. H. P., giving a speed of 7 knots. It is expected that these speeds will be somewhat exceeded. The fuel supply is 850 gallons of gasolene, which will give a radius of action of at least 400 miles.

Dimensions.—Length over all, 63.3 feet; diameter, 11.75 feet; displacement when fully submerged, 120 tons.

ARMOR.

TEST OF 6-INCH PLATE FOR THE MAINE.—The second test of the 6-inch Krupp armor plate designed for the battleship Maine occurred June 11 at the Indian Head Proving Ground. The results were highly satisfactory. The partial failure of the first test was not due to faulty construction of the armor plate as a whole, but to a defect existing in one end of the sample plates tested. The first projectile fired in the test of June 11, a 6-inch armor-piercing shell, struck the target, made of the same plate, with a velocity of 2016 feet a second. The projectile smashed on the face of the plate, the total penetration attained being 3⅓ inches. Another shot penetrated 2½ inches, and a third only 1¾ inches.—*Army and Navy Journal*, June 15.

TEST OF 6-INCH PLATE FOR THE MISSOURI.—A test of the first specimen of the Krupp armor for new battleships, submitted by the Carnegie Steel Company, was made July 17 at the Indian Head Proving Grounds, Maryland. The plate represented a group of 412 tons of armor for the Missouri. It was six inches thick and a 6-inch gun was used. Three shots were fired, at velocities, respectively, of 1865, 1890 and 1900 feet a second. These secured penetrations, respectively, of 2¼, 2½ and 2¾ inches. No cracks were developed and the flaking and condition of the plates were normal. The test was regarded as highly successful and the group of armor will be accepted.—*Army and Navy Journal*, July 20.

NEW PROCESS FOR BUILDING UP HARD-FACED PLATES.—An experimental armor plate manufactured by a new process has recently been turned out from the works of the Carbon Steel Company at Pittsburg. By this process, when the steel ingot from which an armor plate is to be made is cast, half of the mould in which the ingot is cast is filled with a plumbago core. Soft steel is then poured in, filling the other half of the mould. When this has been cooled so that it will not run, the core is taken out and its place is filled with very hard steel. The plate is then finished by being rolled instead of forged. The result is said to be a plate with a very hard face, which resists the penetration of a projectile, combined with a soft back, which prevents the plate from being fractured.—*Engineer* (London).

This is a return to the compound plate system of a dozen years ago. The Messrs. Jessop, in England, endeavored to build up steel plates in this way, but they were not successful.

TEST OF 6-INCH COSGROVE PROCESS PLATE.—A test of an armor plate treated by the Cosgrove new face-hardening process was made at the

naval proving grounds, Indian Head, Maryland, on July 3. Two shots were fired from a 6-inch rifle at 6-inch armor plate, the first at a velocity of 2000 feet a second, perforating the plate. The shell broke in pieces. Some of the fragments penetrated the backing of the plate. The second projectile, fired at a velocity of 1490 feet a second, was not broken up, and its face was flushed with the hard surface of the plate. The result showed that the process had been improved since first tested several months ago; to what extent the official report of the trial will show.—*Army and Navy Journal*, July 6.

TEST OF 9-INCH PLATE FOR THE VENERABLE.—A 9-inch Krupp face-hardened plate was tested at Whale Island, near Portsmouth, England, June 25. It was one of several designed for the belt of the British battleship Venerable, and was made by Sir John Brown & Company, of Sheffield. A 9.2-inch gun was used. The projectiles weighed 380 pounds and were made by Messrs. Jacob Holtzer & Company, but it is likely that they were eight or ten years old, as the Messrs. Holtzer have recently stated that they have not furnished any projectiles to the British government for many years. The striking velocity was 1900 foot seconds and the maximum penetration 3.5 inches, but a crack which formed near the edge of the plate was 4 inches deep.

TEST OF NEW 4-INCH NON-CEMENTED PLATE.—Last week sample plates of 4-inch non-cemented armor submitted by Sir W. G. Armstrong, Whitworth & Company, Openshaw Works, Manchester, as specimens of armor for the cruiser Lancaster, the contract for which vessel, with her armor, has been placed with the firm, was tested at Whale Island, under the superintendence of Captain A. Barrow and Lieut. Drury-Lowe. The plates measured 4 feet by 4 feet, and each was required to stand three rounds of armor-piercing projectiles from the 4.7-inch quick-firing gun, fired with a striking velocity of 1635 foot seconds. The results of the tests showed that the service requirements were satisfied in every respect, the order for the armor being conditional upon the satisfactory tests of three plates. Five plates were tested, from which the necessary standards for guidance in manufacture of the armor for the above ship were selected. The average penetration was under 1 inch, and no cracks or bulges were developed on the backs of the plates, which were in the same state as before firing. Other plates of greater thickness and harder quality—namely 9-inch and 12-inch—are now being submitted by the same firm for trial under service conditions.—*Engineering* (London).

NEW VICKERS-MAXIM PLATE.—A new armor plate by some special process invented by Messrs. Vickers-Maxim, so we hear, has been tested at Whale Island. As to what the process may be we are ignorant; but we do know that so far 6-inch projectiles that ought to have made an impression on it have failed to do so. They simply "danced off," according to all accounts.—*Engineer* (London).

ARMSTRONG & CO. ACQUIRE RIGHT TO MANUFACTURE BY KRUPP PROCESS.—It is announced that the firm of Sir W. G. Armstrong, Whitworth & Co. has practically concluded an arrangement which will enable them for the future to make armor plate by the Krupp process up to any thickness—a privilege which had been confined hitherto to the three Sheffield firms and to Beardmore & Co., of Glasgow.—*Engineer* (London).

THE MANUFACTURE OF ARMOR IN GERMANY.—The question as to the manufacture of armor plates has again been raised in Germany, in consequence of the circulation of reports relating to the intentions of the government in regard to the matter. It may be remembered that a few

months ago, when considering the navy estimates for the current financial year, a resolution was adopted by the Reichstag expressing the opinion that the government should establish state works for the production of armor plates, with the object of economizing the national expenditure on this item of construction in connection with the large scheme for increasing the German Navy. It is now reported by some of the German papers that the government does not propose to erect such works, and, it is added, that armor plates can at present be obtained from Messrs. Krupp—who, with the Dillingen Works of the late Baron von Stumm, have a monopoly of this trade in that country—at cheaper prices, seeing that the adoption of the navy extension program has enabled the government to conclude contracts on a large scale, whereas in former years it was only possible to buy in detail, that is, in small quantities. The statements made to this effect have apparently aroused the ire of the Cologne *Volkszeitung*, which points out that the latest naval scheme was adopted over a year ago, and that there are no essential alterations in the requirements in the matter of armor plates for 1901 and subsequent years in comparison with 1898, 1899 and 1900. The assertion that it is now possible for the government to enter into large contracts is characterized as quite incorrect, as everything is subject to annual sanction through the Budget. It is, however, obvious from the reports that the authorities of the Admiralty do not intend to give effect to the resolution of the Reichstag in favor of the establishment of a government armor-plate manufactory, the reason adduced being that no reduction in the price would be obtained by producing under State auspices. The Cologne paper submits that this is an extremely naive explanation, as the persons in authority should know full welll that the cost to the manufacturers of armor plates hitherto sold at £116 per ton only amounts to from £48 to £50, and that even if a reduction has now been made to £96 per ton the makers still receive a profit of 100 per cent. Do the naval authorities, the paper continues, really believe that they would under all circumstances be compelled to produce armor plates in government works at a price of 100 per cent. higher than the cost incurred by the present makers? In this connection it may be mentioned that some time ago a Rhenish syndicate expressed its readiness to commence the delivery in 1903 of nickel steel armor plates of the same quality as those now used at the rate of £77 10s. per ton, or £38 10s. per ton less than the price hitherto paid, provided that the government would undertake to give it a fair share of the orders for armor plates. This offer appears to have come to the knowledge of the present contractors, who have agreed to reduce the price to £96 on the assurance that the government would obtain all its supplies from them until the year 1907. As far as purchases in detail are concerned, the Cologne organ mentions that during the years 1898, 1899, and 1900, the deliveries of armor plate to the Admiralty amounted to from 16,000 tons to 18,000 tons, at a price of about £1,850,000 to £2,050,000, leaving a profit to the manufacturers ranging from £1,000,000 to £1,500,000. It is, of course, highly questionable whether the profits amount to anything like the extent cited by the Cologne paper in the case of a specialized industry such as that of manufacturing armor plates, where a large capital expenditure is required for the purpose of equipment with complete modern machinery, the value of which has to be written down considerably every year, in view of prospective improvements in the manufacture which may possibly cause a plant that is up-to-date at the present time to become

antiquated in from five to ten years. At the same time, the fact is interesting that a Rhenish syndicate has expressed its readiness to supply armor plates at £77 10s. per ton by the year 1903, although no government would be disposed to commit itself to delay in delivery by awaiting the pleasure of a new undertaking to start an industry of which it has had no previous experience. The name of the Rhenish syndicate does not appear to have been disclosed, but a Hoerde correspondent now states that the well-known Hoerde Verein has announced that it is prepared to furnish large quantities of nickel steel armor plates. Whether these two are identical is a matter for conjecture, but there is no doubt that the manufacture of armor plates is engaging a larger share of attention in Germany at the present time.—*Engineer* (London), June 14.

COMMUNICATIONS.

NOTE.—Under this head will appear notes on Signaling, Telegraphy, Ocean Cables, Carrier Pigeons, etc.

WIRELESS TELEGRAPH APPARATUS FOR BRITISH SHIPS.—The Admiralty has informed the Devonport dockyard authorities that battleships and cruisers in commission for the home stations, and all vessels being prepared for the Reserve, Training, and Channel Squadrons, shall be fitted with wireless telegraph apparatus. All future battleships and cruisers sent to the Mediterranean are also to be so equipped. Apparatus Newton coils are being used.—*Engineer* (London), May 24.

CONSTRUCTION.

NOTE.—Under this head will appear notes on Design, Materials, Sheathing, etc.

FIRE-PROOF WOOD IN U. S. NAVY.—The Secretary of the United States Navy, on June 22, approved a unanimous report of the Board of Construction, recommending the discontinuance of fireproof wood for decks and for all joiner work below protective decks on vessels having protected decks, and on all vessels below the berth deck. Wood treated by the fireproofiing process will be used, however, in torpedo boats and torpedo- boat destroyers, and will be painted. In other ships metal will be used in place of wood wherever possible. The recommendation of the board was based on reports received concerning the utility of fireproof wood. A bonfire was made of fireproof wood taken from the decks of the Helena at Manila. The surgeon of the Wisconsin complained that mould gathered on the fireproof wood of his sick bay. The reports of U. S. Naval Constructor Baxter, who made tests at Boston, showed that the wood when exposed to the weather for a week loses 50 per cent. of its fireproofing qualities, and that the fireproofing process made wood brittle.—*Engineering* (London), July 12.

WOODEN DECKS NO LONGER USED IN BRITISH NAVY.—An Admiralty order has been issued directing that there are to be no wooden decks in any warship laid down in the future or now building, nor is it to be used in the construction of the cabins.—*Army and Navy Journal*, July 20.

SHEATHING OF THE ARGONAUT: GALVANIC ACTION, ETC.—We are sorry to hear from the China Station that the bottom of the Argonaut is said to be in a bad way. The wood sheathing seems to have been loosened in some way, admitting water, which is setting up galvanic action. It is possible that the ship will be ordered home at the end of her com-

mission, or before; facilities for the necessary repairs being hard to obtain.—*Engineer* (London), June 28.

This is the third vessel in this class in which the sheathing has given trouble and the fact seems to indicate that the method of applying the sheathing is in some way faulty. But in the absence of definite details we can arrive at no conclusion.

GUNPOWDER AND EXPLOSIVES.

COMPARISON OF THE ENERGIES OF SMOKELESS AND BROWN POWDERS.—The following table is furnished by Lieutenant W. G. Turpin, U. S. N., on duty at the Indian Head Proving Grounds.

Gun.	Length Calibres.	Weight Charge.	Weight Projectile.	Muzzle Velocity, f. s.	Muzzle Energy, ft. tons.	Energy per pound of Powder.	Cost per ft. ton of Energy.	Remarks.
13″	35	286	1100	2340	41753	146	.006165	Navy Smokeless.
12″	40	353	850	2822	46950	133	.00677	" "
12″	35	213	850	2252	29883	140	.00643	" "
8″	35	62.6	250	2367	9709.6	155	.0058	" "
6″	40	27.8	100	2456	4183	151	.00598	" "
6″*	45	36	100	2828	5544	154	.00583	" "
6″	50	45.5	100	2922	5919	130.1	.00692	Navy Smokeless.
6″	45	29.9	100	2821	5516	184.5	.00488	Cordite.
13″	35	515	1100	1998	30440	59.11	.00542	Brown Prismatic.
12″	35	406	850	1955	22521	55.5	.00576	" "
8″	35	885	250	1802	5627.3	63.2	.005062	" "
6″	40	41.5	100	1932	2587.5	62.35	.00513	" "

*The data given for this piece with Navy smokeless are meagre.

Referring to this table, Lieutenant Turpin says:

"From the above table it appears that the cost per foot ton of energy is different for different guns; also that the navy smokeless is more expensive per foot ton of energy than is brown powder, and cordite is the least expensive.

"There is a variation in the cost, no two calibers of guns giving the same figures; but if the guns be arranged in the order of cost for the two powders we will see that they are in the same order in each case. This arrangement is as follows: 8-inch, L/35; 6-inch, L/40; 13-inch, L/35; 12-inch, L/35; 12-inch, L/40; 6-inch, L/50.

"In computing the energy for smokeless powder, cases have been taken in which the powder was completely burned and no energy was lost through incomplete combustion. The cost per ton of energy for each powder is computed using a cost of $0.90 per pound for smokeless powder, but it can now be bought for $0.70 per pound, hence the cost per foot ton of energy using navy smokeless powder should be much reduced.

"The mean energy per pound of powder is 142.5 foot tons for smokeless powder and 60 foot tons for brown powder, and the mean cost per foot ton is therefore $0.00632 for smokeless powder and $0.00533 for brown.

"With smokeless powder at 70 cents per pound the cost per foot ton of energy with smokeless powder would be $0.00493, which makes it cheaper than brown, considering the work done, and nearly as cheap as cordite."

NEW SMOKELESS POWDER.—Lieutenant J. B. Bernadou, U. S. N., has patented (date of British patent April 24, 1901) a smokeless powder which is briefly described as follows: Nitrocellulose of the kind insoluble in a mixture of ether and alcohol at ordinary temperatures is worked in a doughing machine with ether alone while subjected to an excessively low temperature, such as may be produced by liquid air. The resulting colloidal substance is used with other insoluble nitrous matter to constitute a smokeless powder, which, containing as it does ether alone as a solvent, can be more perfectly dried than powders in which water and alcohol are constituents.

SMOKELESS POWDERS: CEMENTING AGENT.—Lieutenant Bernadou has also patented (date of British patent April 20, 1901) a cementing agent or binder for the use in the manufacture of smokeless powders and briefly described as follows: A colloid which may be used after drying as an explosives cementing agent, consisting of insoluble nitrocellulose immersed in ethyl ether. This is exposed to a very low temperature, below that of freezing ethyl alcohol, 95 per cent. absolute volume, and it goes into solution or forms a jelly resulting in the formation of the colloid. Once in solution the nitrocellulose does not again revert to its original form, but constitutes a body which may be used as a binder in the manufacture of smokeless powders containing other ingredients.

THORITE: REMARKS.—Ordnance officers are so decidedly of the opinion that thorite is worthless as compared with several other things that caution should be shown in committing the government to its use. An officer who has experimented with this explosive, says: "We never tried so hard to get something out of nothing as we did with thorite. It is useless; turns to water in twenty-four hours on exposure, and is simply one of a dozen other hazards that have been grabbed for in the hopes of getting hold of something new."—*Army and Navy Journal.*

Thorite is a mixture of nitrate of ammonia and a hydro-carbon, such as coal tar or asphaltum, containing ten to fifteen per cent. of the latter. As nitrate of ammonia is a salt without a metallic base the products of combustion are wholly gaseous. It contains, besides, sufficient oxygen for the combustion of the hydro-carbon. Thorite is prepared by melting the hydro-carbon and stirring in the nitrate of ammonia. The hydro-carbon thus covers the nitrate of ammonia and to some extent protects it from the air. Nevertheless the protection so afforded is insufficient and the nitrate absorbs water from the atmosphere so fast as to render it inert unless the greatest precautions are taken. The first tests of thorite as a shell charge were fairly successful. It was perfectly safe to fire with the highest pressures and velocities and it broke up the shell in a satisfactory manner. It would not, however, stand firing through thick armor, packing forward with such violence that the explosion took place before complete perforation. This packing forward carried it away from the fuse when firing through thin armor and usually prevented explosion. When loaded under pressure sufficient to prevent packing the density rendered it inert and very difficult to explode—practically impossible, in fact. In addition to its hygroscopic tendencies, thorite was found to be very erosive, attacking the metal of the shell and of the fuse stock, and at the same time destroying its own power.

EXPLOSION OF NAVAL MAGAZINE AT MARE ISLAND.—The *New York Tribune* of June 22 reproduces a remarkable photograph of the explosion of the powder magazine at the Mare Island Navy Yard at 6 A. M. on June 5, in which half a million dollars' worth of government explosives

went up in smoke. An enterprising photgrapher who happened to be up early secured an excellent snap shot of the gigantic cloud of gas, several miles high, from a point near Vallejo, Cal., one and a half miles from the scene of the explosion.

This picture is perhaps unique, for the gas was chiefly that from smokeless powder, which lasted only a few moments. Showing the enormous height to which the column ascended, it explains clearly why no greater damage was done to the surroundings. The magazine was a stone structure, with walls nearly five feet thick, covered by a light roof. The building measured 150 feet by 50 feet. It contained 300 tons of powder, most of it the new smokeless variety made since the Spanish War, costing $1800 a ton, with a small quantity of old brown powder, valued at $500 a ton. It was apparently ignited by spontaneous combustion, fortunately at an hour when no workmen or keepers were near, and beyond a slight initial shock and rumbling, was noiseless. The roof was shattered and lifted so high that a large section of it fell at Valona, more than two miles away. The quick destruction of the roof, releasing the gases from confinement, had the effect of converting the magazine into a huge mortar, with muzzle vertical, and its entire charge was blown straight up, igniting, as it went. After the photograph was taken, buildings surrounding the magazine ignited, and the white cloud was replaced by black smoke. Five engines from the navy yard and from Vallejo and many tugboats got the fire under control in an hour and extinguished it in course of the day.—*Army and Navy Journal*, June 29.

GUNS.

GATHMANN 18-INCH TORPEDO GUN.—This is Mr. Gathmann's name for his gun. The gun resembles an ordinary gun of 30 calibers length, except that the jacket and long chase hoop are rather thinner in proportion and the usual outside hoops are omitted. As the designed chamber pressure is only 9 tons, the strength of the piece seems ample. It is designed to throw large charges of high explosive. The shells are of nearly the ordinary shape and weight for a caliber of 18 inches, but have thin walls and are otherwise modified internally. The principal details are:

Total weight, 59.6 tons; total length, 44.0 feet; diameter over chamber, 45.0 inches; thickness over chamber, 13.7 inches; maximum tangential strength per square inch, 40,300 pounds; maximum radial strength per square inch, 38,500 pounds; rifling, Gathmann type; twist, zero to 1 in 25; powder charge, 310 pounds; projectile, 1,800 pounds; pressure in chamber (maximum), 20,000 pounds; muzzle velocity, expected, 2,100 foot seconds; gun-cotton charge of torpedo shell, 600 pounds; weight of torpedo shell, 1,800 pounds; muzzle energy at 2,100 foot seconds, 55,000 foot tons.

Mr. Gathmann claims that from tests which have been made with 12-inch torpedo shells fired at velocities exceeding 2100 f. s. that it has been determined that a forward direction is always given to the explosive wave when the torpedo shell is exploded by a base fuse. It is not exactly clear what Mr. Gathmann means, but if he desires to convey the meaning that the force of the explosion is expended chiefly in one direction, as humble students of the laws of motion and of the action of explosive gases, we certainly must dissent. But, of course, the force of the ex-

plosion may be very great in any direction. The Gathmann gun here described is soon to be tried against a 12-inch Krupp armor plate in competiton with the army 12-inch service rifle of nearly equal weight and cost.

NEW SKODA 9.45-INCH GUN.—The Skoda Company, of Pilsen, Bohemia, is now building guns of large caliber. The first of several 9.45-inch guns for the Austrian Navy was recently tested with satisfactory results. Thirty rounds were fired with full charges, the gun being examined and gauged after each shot. No deformation or weakness was discovered. The gun is to be placed on board one of the new battleships of the Habsburg type (see PROCEEDINGS *No. 97*, page 151), which will be launched in October. The marine committee, before whom the test was made, decided not to adopt the Vickers breech system but to retain the Krupp wedge on the ground that the adoption of the former would entail a dependence upon Great Britain for naval guns. The process of reasoning by which this conclusion is reached is not clear. Possibly the Skoda Company declines to purchase the right to manufacture under Vickers' patents.

DAWSON AND SILVERMAN SEMI-AUTOMATIC MECHANISM.—Lieut. A. T. Dawson and Mr. L. Silverman, of London, have brought out a new type of semi-automatic mechanism applicable to the Hotchkiss type of rapid firing guns. The recoil of the piece opens the breech, extracts the empty case, and locks the block. A hopper holding three cartridges is located above and to the rear of the breech. The brief of the patent specification is not very clear, but apparently the empty case flying to the rear trips a spring and causes the lower cartridge to be dropped and thrown forward with an impulse sufficient to load it and trip the clutch holding the breech block down, which latter then rises and closes the breech ready for firing. The hopper is fed from the top and is kept supplied by the loader. If the operation of this gun is as above described and works satisfactorily it is a splendid solution of the semi-automatic problem.

BARRY AND PEMBERTON RAPID FIRING MECHANISM.—Mr. J. H. Barry and Mr. R. I. Pemberton, of Lee, England, have brought out a special type of breech mechanism. The gun is furnished with a double breech, or two chambers, which alternately take up the position for firing through an oscillating movement. The two chambers of the breech block are loaded by two slides which are fitted with hoppers containing the cartridges. The oscillating movement is produced by a lever which has a rocking action. The lever may also be used for firing.

NEW BETHLEHEM BREECH CLOSURE.—The Bethlehem Steel Company have recently taken out patents for a new system of breech closure, the date of the British patent being May 18, 1901. A brief description of the system is given as follows: "A breech mechanism for ordnance, in which the screw-box and the breech-block are provided with threads, the faces of which threads coincide with involute curves or are composed of a succession of relatively eccentric circular arcs. Thus the threads make contact throughout their entire length when the breech is closed, and the threads on the block are parallel to those on the box when the block is in its unlocked position, and there is, therefore, a uniform and a least possible clearance."

VICKERS-MAXIM 7.5-INCH GUNS FOR SPAIN.—It is reported that the Spanish government has placed a large order with the Vickers-Maxim Company for some of its new 7.5-inch guns. A special naval commission from Madrid visited London in May to examine these pieces. The

statement concerning the order must be regarded as doubtful until we find that the Spanish government is going to build ships to put the guns on. It is of course possible that they will replace the 9.4-inch guns of the unfinished cruisers of the Maria Teresa type, which in turn replaced the 11-inch guns of earlier ships of the same class.

PROPOSED GUN FACTORIES IN ITALY.—It is stated on fairly trustworthy authority that the French company, Schneider, of Creusôt, and the much talked of German firm of Ehrhardt, are both engaged in obtaining sites in Italy, at Milan and Spezzia, for the establishment of factories. There seems to be a very keen competition among the continental companies for the securing of the Government orders of the various European powers, and Italy is generally regarded as a happy hunting ground in the process.—*Arms and Explosives*, June, 1901.

SIMPSON AUTOMATIC RIFLE.—In regard to this piece, *Arms and Explosives* says: That ingenious inventor, Mr. W. S. Simpson, has recently turned his attention to warlike devices of a death-dealing nature. One consists of what has been described as a "bijou Maxim" gun, which is almost capable of being carried in the pocket. At all events, it can be transported by one man, and is worked by him without any assistance. In action, he plants the gun on the ground, with a sort of saddle-frame attached to the hinder end, and assumes a prone position across the saddle, thus holding the gun firmly in position. The elevation and direction of the gun are secured by means of the ordinary elevating and traversing screws. Twenty cartridges are fed into the gun at a time from the right-hand side of the chamber, and it is claimed that 100 rounds can be fired per minute. Apparently, this machine-gun is also capable of being fired from the shoulder, if necessary, as it weighs only 3 lbs. more than the service small-arm. Another device of Mr. Simpson's provides for fitting an ordinary military rifle with rests, so that a man need only assume the prone position, fix his rests in the ground, and start pumping lead and nickel for all he is worth. These rests can be folded up along the rifle when not in use, and do not interfere in the slightest with the use of the rifle as a shoulder-piece, or with the employment of the bayonet. It looks, at the outset, as if Mr. Simpson had struck on two good ideas; but in the absence of extended trials made under Service conditions, one can scarcely say more than this. Many ingenious inventions fall short under practical tests of a rough-and-ready nature.

AUSTRIAN FIELD GUNS.—Up to the present, three batteries of six pieces each of C/99, belonging to the 3d, 4th and 10th brigades of artillery, have been issued for trial.

The caliber is 7.65 centimeters (3.01 inches). The pieces are made of forged bronze, perfected by a process devised by General von Tiele. The cartridges are in metal cases (at present and provisionally separate from the projectile). The breech closure is eccentric, similar to that of Nordenfeldt and Deport, yet considerably more simple. Two or three batteries of six pieces of this type, but built of nickel steel by the Skoda Company, will next be issued; also bronze shell-guns of the field howitzer type of caliber 10.5 cm. (4.13-inch). There is in service under trial a mountain battery of 7.2-cm. caliber, also of bronze, and with the new breech mechanism. A battery of three or four pieces of the Ehrhardt type will be tried during this year. It is to be noted that the batteries under trial are placed under the authority of commanders of divisions of infantry.—*Revue du Cercle Militaire.*

NEW ITALIAN FIELD GUNS.—A battery of six of the new quick-firing field-pieces has been lately inspected by the King of Italy on the Polygon, near Rome. The results obtained are reported by the "Esercito Italiano" to have been extraordinarily satisfactory both with regard to the accuracy of fire of the guns and the ease and celerity with which they could be manœuvred and brought into action. The guns, carriages, projectiles and entire equipment are exclusively of Italian manufacture—the guns, of steel, having been made in Turin and the carriages and other accessories in the military arsenals in Terni, Genoa and Naples, while the projectiles have been furnished by the Glisenti Company in Brescia. The calibre of the guns is 75 millimeters (2.96 inches). The projectiles weigh 6.7 kilogrammes (14.7 lbs.) and have a muzzle velocity of 500 metres (1,640 feet) with a range of 7,000 metres (7,655 yards). The weight of the gun itself is 350 kilogrammes (practically 7 cwt.), or of the gun with its carriage and limber, 1,700 kilogrammes (33 cwt.)—*United Service Gazette*, London.

GUNS: FIRING

NOTE.—Under this head will be given notes referring to firing tests of guns, target practice, special practice, accidents to guns while firing, etc.

SCORPION EXPERIMENTS.—Interesting experiments to test the effect of gun fire on warships were held at Hamilton, Bermuda, May 14, under the direction of British naval officers. The old iron-clad Scorpion was used for a target vessel, and a number of dummy figures were set up on her in different places to represent her crew. The warship Crescent then took a position at from one to two thousand yards and began firing. Unofficial advices concerning the firing state that the first shots fired at the Scorpion were from 3-pounder and 6-pounder quick-firers at one to two thousand yards range. Afterward the Crescent steamed off to about six thousand yards and opened fire with her 6-inch guns. The quick-firers played havoc with the dummy figures, and everything destructible on the Scorpion's decks, showing it would have been impossible for any crew to survive such a fire. The firing from the bigger guns, although the shells were accurately placed, was not so good. Out of about twenty shell only two or three hit the mark. These, however, were very destructive, and it is understood that the effect of the lyddite shell was regarded as satisfactory. One shell, which burst inside the Scorpion, practically wrecked everything on board.—*Army and Navy Journal*, June 15.

NEW BRITISH 12-INCH GUNS: SPEED OF FIRE.—According to *Engineer* of June 26, at recent trials at Portsmouth the gunners succeeded in firing one projectile of 850 pounds every 24 seconds from a 12-inch, 50-ton gun supplied with the new breech mechanism.

NEW BRITISH 12-INCH GUNS: MOUNTS AND SPEED OF FIRE OF THE GUNS OF THE FORMIDABLE.—During last month H. M. S. Formidable carried out her gun trials under the supervision of Captain A. Barrow, of H. M. S. Excellent, gunnery school, in most successful fashion. The tests were of especial interest, since this battleship is the first to be fitted with an improved design of hydraulic machinery, designed and supplied by Sir W. G. Armstrong, Whitworth, and Co., Ld., which provides facilities for a considerable increase in the rate of fire of the main armament of 12-inch guns, and incidentally for an increase in the charge of ammunition. In this system there is a special chamber immediately below the

gun platform to which the charges are raised independently of the guns, so that one or two charges may be in waiting in close proximity to each gun of the battery only awaiting a comparatively small final hoist into the loading position. The rate of fire is therefore practically controlled by the efficiency of the crew actually working the gun, and their operations are also aided by a new departure, which allows of the loading being done when the gun is inclined at an angle of only 4½ deg., as compared with the hitherto prevailing inclination of 13½ deg. As this smaller elevation corresponds to a range of about 4,000 yards, it will be seen that in action the tilt of the gun for loading would often be an almost negligible quantity occupying a minimum of time. In the trials, six rounds were fired in salvos of two each, in 144 seconds, so that each gun actually fired two rounds in rather less than a minute.—*Arms & Explosives*, July, 1901.

NEW VICKERS 9.2-INCH GUN: SPEED OF FIRE.—The Vickers 9.2 gun has attained a rate of fire of three rounds a minute off Portsmouth on several occasions. The Elswick 9.2 worked out at two rounds a minute, or rather two rounds in about fifty seconds. It is not possible, however, to draw comparisons exactly, because the crew which fired the Vickers gun had previously fired the Elswick, and so acquired an additional amount of handiness. There seems little doubt, however, that some speed advantage lies with the Vickers piece, which has a quicker breech action owing to the steep cone system of obturator pad. Against this, certain disabilities in the steep cone system may be put, so that, all told, it is doubtful whether in actual as opposed to experimental practice one gun will be quicker than the other. From such reports as have reached us we should be disposed to place the rate at ten in five minutes for both, the Elswick gun doing a regular two per minute, the Vickers alternating between three in one minute and one in another.—*Engineer* (London), May 31.

NEW ELSWICK 9.2-INCH GUN: ALLEGED SPEED OF FIRE.—In the London *Engineer* of May 10, 1901, the following note appears:

"The Elswick 9.2-inch mounted on the Cressy has got off rounds at the rate of one per six seconds—five rounds in thirty seconds. Now, though this must be discounted somewhat to get at a probable war rate, it must be definitely accepted that the gun can fire at least once in a minute in action."

The compiler's credulity has frequently been stretched to great limits by reports of speeds of firing attained abroad, but this is *un peu trop fort*. The liberal discount made by the writer in the *Engineer* is remarkable if he believed the report.

NEW VICKERS 6-INCH AND 7.5-INCH GUNS: TRIALS, SPEED OF FIRE.—A series of trials of the 6-inch and 7½-inch guns of 50 calibers, mounted on naval quick-firing mountings, was recently made on the gun range at Eskmeals, in Cumberland, by Messrs. Vickers, Sons and Maxim, Ld., before members of the special Naval Spanish Commission. This commission had previously been making a round of visits to the polygons at Essen, Creusôt, and St. Chamond. It was found that, thanks to the special arrangement of the mounting, in conjunction with the new breech mechanism, five aimed rounds could be fired in 37 seconds from the 7½-inch gun, or at the rate of eight aimed rounds per minute. This rate of fire is similar to that obtained from the latest pattern of Vickers' 6-inch guns, at the official trials. Without exceeding the limits of the working pressure of the guns, the 6-inch gun gave a muzzle velocity of

2,900 feet per second, and the 7½-inch gun 2,903 ft. per second. The weight of the projectile for the 7½-inch caliber is 200 lbs., giving a muzzle energy of 11,687 ft. tons.—*Arms & Explosives*, July 1901.

VICKERS 14-CM. AND 6-INCH GUNS: SPEED OF FIRING, ETC.—Some important gunnery experiments were carried out on Tuesday at the heavy range of Messrs. Vickers, Sons, and Maxim, at their range at Eskmeals, in the presence of the members of the Spanish Naval Artillery Commission and representatives of the Turkish, Argentine, Mexican, and Peruvian Governments. The programme included rapid-firing series from 14-centimetre, 14-pounder, 37 and 47-millimetre guns. A rate of fire of ten rounds per minute was obtained from the 14-centimetre gun, and a velocity of 2950 ft. per second with the 6-inch gun with nitrocellulose powder. The special feature in connection with the rapid-firing series with the heavy guns was that no metallic cases were utilized for holding the powder, whereby a great saving in weight of ammunition as carried on board ship is effected, and a much more rapid rate of fire is obtained. The cartridge cases necessary to carry the large charges of powder to develop the high energies required are very heavy, and by their use the rate of fire is not only reduced, but the weight of the whole armament is much increased, thereby limiting the number of rounds it is possible to carry. The system of not making use of cartridge cases for heavy ordnance has been adopted by the British Government, as opposed to the cartridge case system employed by Krupp and the French firms.—*Engineering* (London), May 24.

TARGET PRACTICE IN THE BRITISH NAVY: PRIZE FIRING OF THE TERRIBLE.—Last week we referred to the fact that the Terrible has just returned into harbor from prize firing, and that with her twelve 6-inch guns she had fired 128 rounds and made 102 hits. Further information has now come to hand on the subject. The Service prize-firing target was used, the distance 1,400 to 1,600 yards, the speed of the ship twelve knots, and weather fine with a moderate swell. Each gun fired at the target for two minutes, the hits were then counted by independent umpires from other ships. As it was anticipated that the firing would be more rapid than it is generally accepted 6-inch guns can do, extra independent umpires were taken out to carefully verify the time for each gun, and as an additional precaution an attempt was to be made to photograph the target after each gun had fired. It will be remembered that last year this ship headed the list of the fleet with a percentage of hits of 76.8, and an average of hits per gun per minute of 3.33. The following table gives the prize firing of seven ships similarly armed (twelve 6-inch quick-firing guns) in 1900:

Ship.	Number of rounds fired.	Number of hits.	Percentage of hits to rounds fired.	Average hits per gun per minute
Terrible	104	80	76.8	3.33
Majestic.....	108	52	48.1	2.17
Prince George....	93	52	55.9	2.17
Jupiter.....	106	44	41.5	1.83
Magnificent.....	87	30	34.5	1.25
Mars	95	27	28.4	1.13
Hannibal	79	27	34.2	1.13
Terrible (1901)...	128	102	79.6	4.25

Last year it will be seen that the Magnificent, Mars, and Hannibal, with their thirty-six guns made a total of eighty-four hits while the Terrible, with twelve guns, made eighty hits, four short of their total.

This looks as if the Terrible was as good as three battleships. It has, however, been argued by some that, although the three battleships missed the target 180 times, they missed it by so little that they would have hit a battleship. That may be, but a battleship's target is not always a battleship. The prize-firing target's canvas is 20 ft. long and 18 ft. high (360 square feet in area), and it is surprising that three battleships should miss such a large target 180 times out of 260 shots at the comparatively short range of 1,400 to 1,600 yards. How often, it may be asked, would they have hit a fast approaching destroyer?

This year the Terrible appears to have fired much quicker than last year, the rounds fired with the twelve guns being 128, as against 104 last year. Rapidity of fire must (or should) conduce to more hits, as there is less time for the distance to change between the rounds. It is, therefore, most important to encourage it, and comparisons between ships should be made on hits per minute, not upon percentage of hits to rounds fired. The challenge cups presented by Admiral Sir Edward Seymour to his squadron for the best shooting with heavy guns and small arms shows that he has a full appreciation of the value which should be attached to good shooting, and the competition for them will probably tend to raise the standard of shooting with both weapons. In all functions on shore, where representatives from different ships are present, it has always been the custom for the flagship to take the right of the line, but, according to Sir Edward Seymour's memorandum, in future the ship holding his cup for rifle shooting will take the right of the line. These are all indications of a greater interest being taken in both heavy gun and rifle shooting than heretofore (and not before it is wanted); but it is not only the officers who must take an interest, the Admiralty must give encouragement, as we have already suggested, by letting officers know that polishing brasswork is no longer to be the sure and only path to promotion.—*Army and Navy Gazette*, June 22.

Bursting of a 12-Pounder Gun.—A cable from London, England, June 25, announces that during artillery practice on the Isle of Wight, the breech of a twelve-pound rifle blew out, killing Capt. A. LeM. Bray of the Royal Regiment of Artillery, and one enlisted man, and wounding eight other men, three of whom will die. Col. A. J. Nixon, of the same regiment, was also slightly wounded by the explosion.—*Army & Navy Journal*, June 29.

Proposed Test of Mortar Batteries.—The Board on Ordnance and Fortifications has agreed upon the program which will be followed at the coming official test of mortar batteries to be held at Fort Preble, Me. The program is as follows:

1. Have a local board of three artillery officers to determine the equipment required and conduct all the firing.

2. Test the co-ordination of the position finders with each other and with the mortar battery at Fort Preble by directing the position finders upon fixed and moving objects.

3. Test and determine the probable error of the position finders employed.

4. Establish two secondary horizontal lines in connection with the two vertical position finders—one at Fort Williams and one to be installed on Cushing's Island. In addition there should be properly oriented azimuth instruments on Peaks' Island and Jewell's Island for observing the fall of the shots.

5. Arrangement should be made if practicable for obtaining during the firing test the direction and strength of the wind in the morning at Mount Washington. This is desirable, because at the height of Mount Washington and above the wind is generally from the northwest without reference to the direction the surface wind may have at Portland.

6. Mark out, if practicable, on each of the islands—Ram, Inner Green and Outer Green—a target the size of the deck of a battleship. Fire single shots from a mortar pit at Ram Island until one shot falls near the target. Repeat this operation from a second mortar pit for Inner Green, and again from a third pit for Outer Green. With the elevations and azimuths thus determined fire four shots from each of the three mortar pits, with an interval of two minutes between shots. This method is preferred to salvo, since the fall of each particular shot should be identified and the atmospheric conditions of the firing will be the same as if all the shots were fired by salvo.

7. Shots should be fired at the targets on different days, with a fixed powder charge, azimuth and elevation, to ascertain the best means of applying correction to mortar fire. That is, to settle the question of whether or not such correction shall be determined from trial shots for the day or from the surface atmospheric conditions.

8. In this test data should be collected for the preparation of range tables with smokeless powder.

9. A range zone being the area in which, with a consonant weight of powder, the elevation is varied, there should be determined the most suitable boundaries of the range zones and the methods of passing by elevation from one range to another within the same zone.

10. As this test should be wholly under service conditions, use only smokeless powder of a uniform quality and projectiles of a uniform weight.

11. In firing, use each pit of the battery in succession and in each pit each gun in succession.

12. Determine the highest elevation of the mortar at which the axis of the projectile will continue tangent to the trajectory.

13. After the completion of fire at fixed targets, fire at either a moving material target or a hypothetical moving target.—*Army & Navy Journal*, June 13.

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A prize of one hundred dollars, with a gold medal, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1902. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. Any essay not having received honorable mention, may be published also, at the discretion of the Board of Control, but only with the consent of the author.

5. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

6. All essays submitted must be either type-written or copied in a clear and legible hand.

7. The successful competitor will be made a Life Member of the Institute. If the essayist second in order of merit receive "Honorable Mention," he will also be made a life member.

8. In the event of the Prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of a gold medal.

By direction of the Board of Control.

L. S. VAN DUZER,
Lieut., U. S. N., Secretary and Treasurer.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE COAST IN WARFARE.

By LIEUTENANT-COMMANDER JAMES H. SEARS, U. S. Navy.

PART II.

(Continued from No. 99)

One tendency to-day in naval construction is in the direction of armor-clad vessels of extreme size and great power, and in this respect, as in others pertaining to ship construction, nations appear to follow one another. It is evident that the offensive power of a vessel is or should be the first consideration with naval architects, and when that is provided for, then it is proper to cover that power with protection. In some vessels the armor protection takes the form of a belt calculated to protect the flotation of the vessel, or in other words, the gun carriage in combination with a protective deck. In others, the guns are grouped in citadels, and the belt is only of partial extent, or entirely absent; again, turrets are used to cover the guns in combination with other protection to the vessel. Sometimes the exposed hull is entirely covered with a moderate thickness of armor. Frequently the flotability is further pro-

tected by an absorbent filling matter in compartments, subdivisions more or less numerous, and with double or treble bottoms, which still further add to the security, the vessels at best being compromises. The problem confronting the designer or architect is indeterminate. It would be simple and easy for him to design a vessel embodying in a high degree a lesser number of the qualifications imposed upon him, but the maximum offensive with the maximum defensive are somewhat antagonistic qualities, and the different ways in which the solution of the problem is worked out have produced the varying results to be observed in the heterogeneous make-up of modern fleets. The monitor type and the "New Ironsides," contemporary types, furnish one illustration of the development, at that date in either direction, of complete armor protection. To-day the monitor type and that of the Dupuy de Lome, perhaps, are at either end of the scale. The question of the relative offensive power of either type in engaging with land defenses was settled beyond all dispute in the Civil War, for when the Ironsides turned her broadside on any single work with which she was engaged before Charleston she compelled the gunners to seek shelter. Three shells in the air at one instant were incomparably more effective than the slow practice of the turrets.

In a discussion in the United States Naval Institute in 1879 two officers who were present in Charleston stated that in the various attacks of the ironclad squadron upon the earth and sandworks, that the New Ironsides with her broadside, which was composed of seven 11-inch guns and one 200-pdr. Parrott rifle, could silence Wagner or Gregg with comparative ease; whereas, when those works were engaged by several monitors, uniting an equal or greater number of equal guns, the weight of metal being in excess, the batteries were not only not silenced but briskly returned the fire of the monitors. It was further stated that often the monitors upon withdrawal would be replaced by the New Ironsides with the result of securing silence in the batteries.

The monitor type pure and simple, which needs no description, might safely contend with the horizontal fire from low placed batteries; its passive defensive properties are a maximum except that the muzzles and chases of the guns are liable to

serious injury from small projectiles, even to disablement; but against properly designed and dispersed fortifications the offensive powers are a minimum. It is generally recognized that the most efficient way of attacking earthworks is by a great volume of fire, which can be obtained only by the use of a large number of moderate sized rapid-fire guns.

At Alexandria, the effective work was done by projectiles reaching the embrasures of casemates or the guns themselves en barbette, and by the use of a rapid fire the chances for such hits are greatly enhanced. The addition of a rapid-fire armament to monitors without adequate protection only exposes them to destruction from the same character of fire from shore, where no limits are placed on the number or disposition of the rapid-fire guns. As they can be given mobility with almost complete invisibility, and firing from a fixed point with known ranges at large targets, no comparison seems necessary concerning the effectiveness of fire. The monitor type is quite as vulnerable to plunging fire as other types, and more exposed to it from the low freeboard characteristic of the type.

The completely armored vessel can engage fortifications only by exposing its broadside. The dispersion of the armor reduces its thickness until it is entirely exposed to rupture by smaller projectiles than would be effective against monitors. Such a vessel is also liable to many dangerous hits through the numerous ports by the rapid-fire armament. In other respects these vessels offer the most complete protection to the crew against the smaller rapid-fire guns on shore. Vessels engaging one another do so on equal terms, and it is, generally speaking, historically correct that victories were not won by sinking vessels. They were overcome or dispersed through the loss of their fighting efficiency. To-day, the vessels with the least efficiency against modern coast works are perhaps the best protected against such works, while those best fitted to cope with such works in gun efficiency are the most exposed to the loss of that efficiency.

A question of great importance intimately associated with that of coast defense generally, is that concerning so-called *coast-defense vessels.* It is possible that there exists a confusion in the popular mind as to what is meant by the term *coast-defense*

vessel. The term is used indifferently at times as denoting vessels of various types, and intended for widely different ends—the central idea, however, being generally well understood. If there be misconception and confusion in the one respect, it is otherwise commonly agreed that a coast-defense vessel is a vessel whose scene of operations in a maritime war is confined and restricted to the coast of the nation to which it belongs. Such a vessel is forbidden for one reason or another to take part in any of the naval operations which have for their theatre the open sea or the enemy's coast, if distant.

In the same sense that harbor defenses or fixed defenses are spoken of as coast defenses, harbor-defense vessels are occasionally referred to as coast-defense vessels. The error is not frequently made, but it is well to draw the distinction. Harbor-defense vessels are, of course, those whose actions are still more restricted, as they are assumed to find their field of action in actual participation in the defense of a particular harbor. Coast-defense vessels may be harbor-defense vessels, narrowly speaking, upon occasion, but harbor-defense vessels are intended solely to fill a gap in the other defenses provided for a particular location, or themselves to form the entire defense of the locality.

A battleship is understood to be a large ship containing within its displacement all the current approved means of offense and defense, self-sustaining at all points, capable of making any part of the world its scene of operations, of contending with any and all comers in a fair fight by itself or in combination with others of equal terms, as a unit of the fleet or squadron to which it is attached. A coast-defense vessel is one in which certain qualities may have been sacrificed to the end that others may be enhanced, in order that some undoubted superiority in one or more details may result so that it may have the advantage at the point of contact with the enemy's vessels upon and under the threat of attack upon the coast, be it in some mode of attack or in equalizing, in itself, a discrepancy in numbers. If certain qualities have been sacrificed without this corresponding material gain in power, the coast-defense vessel instead of being in her sphere something more useful than a battleship, becomes something considerably less valuable than a battleship under such circumstances. No

reference is here made to depot or station vessels, to gunboats, torpedo gunboats, rams, torpedo-boats, nor to other types which may be restricted in their use to the actual defense of the coast. While being coast-defense vessels, they are, properly speaking, coast-defense rams, coast defenders, or gunboats, etc. If, by a naval policy, sea-keeping or sea-going battleships are restricted in their radius or field of operations to the waters of the littoral, or are compelled to assume that theatre by the power or strategy of the enemy operating as a homogeneous fleet in their coast waters, it must not be assumed that they fill the idea of coast-defense vessels in the restricted sense. If the naval policy directs the dissemination of its battle force along sections of the coast or in particular harbors they would then, in the sense assumed for the term, be coast or harbor-defense vessels without the sacrifice in one direction and consequent gain in another, as before stated.

The fallacy underlying the policy which admits of the dispersion or the localizing of the naval forces, except in the possible case of vessels replacing or standing for floating fortifications, has been before exposed. The mere contemplation of the subject from the point of view of the numbers required to be superior at any possible point of contact, or to make any show of superiority, should be sufficient. This argument of course applies to an assumed case where the naval policy might be committed to such a disposal of its entire fleet. The general reasons for or against the building of special types of vessels for coast defense are presented to us at this day in a more limited sense. It is a question as to whether maritime nations of wealth and power sufficient to enable them to maintain extensive naval forces, should devote any portion of the funds voted for the maintenance of naval power to the early building of such types of vessels. Generally, when the policy of naval powers is considered by the light of their actual building policy of to-day, it may be stated that the answer to the question is in the negative. The policy of building such vessels is receiving and has received a great deal of attention. To illustrate the conflicting views, and to exhibit the wide divergence of opinions which exist, some quotations are introduced, all of which are entitled to respect, some being radical on either side of the question, while others seek a medium ground of argument.

"To build specially for C. D. is perhaps not congenial to the feeling of the country. We aim at a maritime supremacy. It is assured that in case of war we shall best defend ourselves by taking the offensive. Looking, however, to the difficulty of maintaining an effective blockade under modern conditions, it is a question whether the country would approve that it should be left at any time entirely without the protection of the fleet. Until quite recently it was an axiom that we should always have a force at hand strong enough to command the Channel. If this view were acceptable, it might be desirable to build a few vessels of a type which would be effective for coast defense though not adapted to a wide range of operations." (Lord Brassey, 1892.)

"The best coast defense is a fleet of specially constructed ironclads, capable of going to sea in any weather along a coast. Each harbor should have its flotilla of torpedo-boats. These coast-defense vessels should have a great battery power, draw little water, have good speed, and be unsinkable. They need not be strongly manned, . . . They should be accompanied by lookout vessels. The four ships of the Trehouart type seem to meet the requirements of a coast-defense service, displacement 8590 tons, two 30 cm. guns, a powerful armament, speed 17 kn. Improved monitors might be extremely effective for defensive service in the English Channel. Rams should find a place in the shipbuilding programme for the British Navy. In our large fleet no type should be omitted. We want ships of the Polyphemus type, but less complicated and less costly construction." (Admiral Penhoat.)

Captain Eardley Wilmot, after discussing at some length the question of coast-defense by vessels of an especial type and giving his views as to the most efficient defense in which he places the navy above all other means, and instances several well-known cases where the navy operating at a distance has put aside all chances of attack on the coast, says: "Tacit acquiesence in a view which apparently contemplates an enemy roaming over the seas without let or hindrance; on his appearance in force without warning on any part of our coast, seems to have led to the construction of vessels with a restricted radius of operation and incapable of service in distant waters. The desire to have within sight, as it were, a portion of the

fleet becomes at times exceedingly strong." He says again: "In thus dealing generally with the question, I by no means preclude the possibility of raids by single vessels that might escape the most complete system of blockade. At no time has it been possible to prevent such attacks by an enterprising enemy, and there is perhaps greater opportunity for them with steam than before. Under such conditions special vessels for coast-defense service have some justification, and confidence is maintained wherever the rest of the fleet is employed. The weak point of the principle is that the best coast-defense vessel is a first-class battleship, especially for an island, subjected at most periods of the year to weather that is not favorable to any but the most seaworthy craft."

In commenting on the policy of protecting fixed points by fixed forces, Admiral Colomb says: "If fragmentary local protection be a sound military principle of imperial defense, but a short step leads to localizing naval defense either by acts of parliament or, still more surely, by war vessels incapable of keeping the sea. Already there are distinct proofs of Naval Colonial defense—to say nothing of home-theories developing local proclivities. I observe so eminent authority as Sir W. Jervois recommending, for example, South Australia to expend some £150,000 a year of revenue on a three masted ironclad for purposes of local defense. She is not to be a regular seagoing ship, but is to be fit to go a certain distance equivalent to that between Lisbon and the Azores." Sir W. Jervois thus officially speaks of the duties of the Royal Navy in Australian waters: "The Imperial Squadron, small and composed of wooden vessels, being charged with visiting the islands of the South Sea, with the defense of the Fiji Islands, New Zealand, and all the Australian colonies, the chance is but small of its being available for the special defense of any one colony or any particular portion of the coast. We have here a clear illustration of the imperial programme for maintaining economically our naval supremacy. We annex Fiji, being a position of great strategic importance, a necessary point at which to store coal and naval supplies, and as soon as we have got it, it simply becomes a burden to our fleet, . . . We took the point as a means of strengthening our naval position and our arrangements are such that we must weaken our naval position to defend the

point. . . . The principle of localizing the action of a naval force, by ships that cannot keep the sea . . . to my mind contains the germs of creeping naval paralysis, which if not checked will prostrate and destroy our supremacy of the sea."

Vice-Admiral Colomb, R. N., recognized a distinction between a greater or a lesser naval power, as follows: "The error we have fallen into arises, I believe, from forgetting that the strategy of the naval power in command of the sea is necessarily diverse from that of the naval power which cannot hope to have it. France, in building coast-defense ironclads and stationing them at her great war ports, is pursuing a policy which can be supported by sound reasoning. Each of these ships is, in her place, the equivalent of a seagoing ironclad, and would compel the enemy, if he determined to blockade, to appear off the port with a seagoing ironclad for every coast-defense ironclad within it, or to suffer the chances of a reverse. But the superior navy cannot logically contemplate or prepare for any other position than that of the superior navy. If she does, every pound she spends on that assumption is so much subtracted from her own power, so much deliberately spent in encouraging inferior naval powers to hope." Should France really adopt this view there is no doubt that the periodical anxiety which England undergoes in contemplating the material growth of French naval power would be considerably eased.

Admiral Colomb with consummate ability frequently advocated a compact naval force for even the inferior naval power. His flanking fleet, though inferior, as a means of defense, is frequently insisted upon in his writings. The case of the inferior German fleet in the Jahde is one in point which he beautifully used to emphasize his position.

He says: "They (the French) dared not undertake the light business of the simple bombardment of a coast town (Colberg) because there was the neighborhood, 700 miles off, of a German inferior fleet." Assuming that the cause is rightly given, it appears that if the vessels of the compact inferior fleet had been disseminated among the various ports, the cause resulting in the saving of the coast would not have existed. When Admiral Colomb considers that the command of the sea may be called in question, that the maritime war may be brought near the shores of Great Britain, he falls back upon the fleet con-

centrated in the Downs. At such a time it would no doubt be gratifying for the English to know that the French vessels were carefully distributed around the coast. From the Downs, his fleet would seriously impede any concentration or combination against it. The weaker naval power would need the greater assistance from fortifications, and fortifications would certainly gain by the presence of floating defenses, but would the inferior gain by dividing her already weak naval forces? Would she not then have buried her last hope of restoring a resemblance of equality in case she had provided beforehand by such a naval policy for such a division? For all powers less in naval strength than Great Britain, the naval building policy, accordingly, must be based upon a double-headed strategy. They would build against England, and they must build against powers lower in the scale than themselves. The task is indeed great for the intermediate powers. It is undeniably true, and beyond all contradiction, that the strategical considerations governing the actions of stronger or weaker fleets differ widely, but it is permitted to any one to doubt that the nation contemplating the possibility that compels it in turn to adopt either course of procedure should pursue a building policy different in each case. This is apart from the consideration of the effect geographical location, political aspirations, and the configuration of the coastline should have upon such a policy.

In the days of sailing fleets, types were few. There were not wanting, even then, advocates for especial types of vessels to be used in operations on the coastline. But generally, these types were demanded for offensive action, rather than for coast defense. Little is heard of arguments in favor of building coast defenders. When, in war, vessels were found acting in such a capacity, it was because no other rôle was possible to them. The action of the English fleets throughout the Napoleonic wars before the enemy's ports was not offensive as against the coast. Their objective generally had nothing to do with any offensive action against the coastline. It was simply and always the organized sea force that they were after, while that force existed. There was no demand, from the nature of things, for vessels other than lookouts and battleships that were suited to the ends in view. The inferior naval forces

of the continental powers were sometimes forced into the position of mere coast defenders in the narrow sense of the word. In the highest sense, the English ships were coast defenders. As before stated, it was the power inferior in naval force that was obliged to resort to their use, and the operations where they make their appearance follow the usual course and result in the defeat of the inferior force. The coast-defense vessels or gunboats of the Danes, about which a great deal is heard, found their successes in attacking commerce passing by the shores of their country, or in surprising solitary vessels of war. Defeat was their portion when under the guns of Copenhagen.

In the Civil War, such actions were more frequent than any others, and vessels of especial types, frequently very defective, were pitted often against one another. The conspicuous instance of success to the coast defender was the case of the Merrimac before the appearance of the Monitor. In that instance the Merrimac possessed an overwhelming superiority over her enemies. She brought to the action a perfect defense, behind which was developed a maximum of offense in her guns and ram, as compared to her enemy's wooden frigates. The monitors never appear during the war as a present factor in coast defenses. Their action was on the first line of defense in every case where they were employed. Perhaps a fine distinction can here be drawn between the offensive and defensive actions of vessels such as the monitors. As rapidly as they could be built they were sent to the Southern seaboard. There they fulfilled in the completest manner imaginable the duties of coast defenders, but not in the sense of the old line of battleships and frigates. They did not generally watch off the ports, waiting and anticipating the exit of vessels, but put themselves in direct competition with coast defenses and endeavored to strike directly at the enemy. While their object was not avowedly the protection of the northern coastline, it was that object which they, in connection with the main body of the Northern fleets, fully accomplished. It was not popularly recognized at the time just what they were doing; they were supposed to be acting on the offensive exclusively, and in doing so neglecting the duty of guarding the ports of the North.

The President and Navy Department were besieged with petitions and claims that some of these vessels, as rapidly as

they were finished, should be detailed for the protection of the ports of the North. It is well to remember that no vessel or vessels of the Confederate service during that conflict had any serious influence upon the course of the conflict in the waters they were especially charged with protecting, nor did anything occur during the war to show that our vessels were not in their proper positions as before stated. These requests, made as they were over the names of men prominent in official life, must have caused a serious embarrassment to those charged with directing the naval policy of the government.

The Governor of New York State writes as follows: "The subject is of the greatest importance, and I therefore feel it my duty to renew my request, and to make it directly to you, not because the Navy Department has shown an indisposition to act, but because of the importance of the measure to the interests of the city and state of New York and the country, that if the abilities of the Navy Department will not permit a compliance, your excellency will direct that provision be otherwise made to meet this important necessity. What I desire is that an armed ironclad steamer be sent to New York to defend its harbor, and that the necessary order to that end be given by you. The people of New York are alarmed already, but they would be much more so if the defenseless condition of the city was more fully know to them." Secretary Welles had written that "The steamer referred to was probably the New Ironsides, now at Philadelphia, where her presence is most earnestly requested by Governor Curtin. The Galena and Monitor are guarding the entrance to the James River in anticipation of the Merrimac No. 2. Under these circumstances it would seem to be impossible to comply with your request."

The Board of Trade of Boston, in a memorial to the Navy Department, after recapitulating the defenseless condition of Boston, only 153 guns being mounted, and the vulnerability of Boston to an ironclad by Broad Sound, said: "In view of the foregoing facts, we beg respectfully to suggest that the new ironclad steamer Nahant (of the Monitor class), now nearly completed by Mr. Loring, be allowed to remain in this harbor for its defense, at least until the necessary guns are placed in the several fortifications of the harbor and the pirate Alabama had been either captured or destroyed, provided that such dis-

posal of the Nahant be, in any reasonable degree, compatible with the immediate or more important requirements of some other branch of the public service."

The Marine Society of Boston followed with a similar petition.

Many French officers of rank, writers on naval matters, display a marked affection for coast-defense vessels, gardes-côtes, but it is to be noticed that the particular qualities they admire in gardes-côtes are those which make them very desirable for the guerre-des-côtes on some other coast. One of them deplores the lack of such vessels during the war of 1870. With them the courses of the Jahde, the Elbe, and the Weser might have become the scene of some very interesting operations. It is to be noticed further that all, or nearly all, of the examples to which they appeal to support their belief in such vessels are drawn from offensive actions, such as the actions of the Allied flotillas in the Sea of Azof in 1855; those of the Mississippi and Red River flotillas, and others; while for their utility in coast defense the arguments are largely theoretical. Other names frequently given to the garde-côtes, flotte de siège, garde-côte or garde-côtes—offensives, are indicative of the uses to which they are to be put.

Admiral Farragut, at Mobile Bay, waited for the monitors before making his attack. Admiral Sir Charles Napier delayed his operations in the Baltic waiting for especial vessels. In our service, the vessels of especial types for coast service are monitors, torpedo vessels, and rams. Certain qualities have been sacrificed in these monitors, while others as certainly have been enhanced. They are intended for coast service and should be and are classed as coast-defense vessels. I have heard no opinion that they are fitted for war in the open. They need no description, but it may not be out of place to enumerate some of their powers and limitations. Their merits are the steady gun platform in smooth water; the insignificant comparative target; the ideal of protection; the defense against ramming in those having an overhang, and it is rightly contended that without the overhang they are not monitors in the original sense; the nearly all-around fire; the flat floor; and the shallow draft. In the monitor type as at present understood, the faults may be stated to be, the exposure of the long chases of the guns to injury; the low command of the guns;

the small number of guns; the exposure of the under-water compartments owing to the fact that there is the single deck over them; and without the overhang, the liability equally with other vessels to ramming attacks; and as the freeboard becomes greater, their still further exposure. It will be observed that without the overhang, with the longer guns and with the greater freeboard, many of the essential saving principles of the old monitors are wanting. Speed not being desired perhaps, another thing can be set down to their credit, that of much less cost than a battleship of the same displacement. Putting aside the question of their usefulness in the Civil War offensively on the Southern coasts, it may be that their sphere would be found in offensive operations on the coasts contiguous with or adjacent to our own. They could operate in such waters as the Golden Gate, the Mississippi, the Chesapeake, the Delaware, and Long Island Sound, where the problem of local defense by fixed defenses is perhaps somewhat indeterminate, and lastly, they could take their place in harbor defense either as resisting an attack or in attempts to break the blockade.

It is possible, as is often suggested, that the presence of only a few of them might allay the feeling of anxiety in those who demand a local naval defense. Great stress is laid upon their shallow draft combined with their long range ordnance, which will enable them from a position of comparative safety to keep up a damaging fire upon an adversary. The monitor type, or the type known as the monitor type, while fulfilling in this country the idea attached to coast-defense vessels, is also the official embodiment of the harbor-defense idea. One function of harbor defense vessels is to be fulfilled (as before stated) as an element of defense in wide waters incapable of defense by fixed defenses. Another and a similar function is in the defense in front of open coast towns or cities equally incapable of being otherwise efficiently defended.

It is not understood that it is claimed for monitors that their manifest good qualities under certain conditions would serve them in the general service in the open sea. In a seaway it is not claimed that their turret guns can be served to windward effectively, which is a limitation not placed on ordinary battleships. Their guns may be fired, but the target would need be very big and very close. The question as to their superiority

over an ordinary battleship is so far a matter not wholly of experience but of opinion, but they are not fitted for the line of battle. In offensive actions against fixed defenses they have proved themselves to say the least, inefficient, though they have displayed remarkable passive defensive qualities in preserving their own hull when under fire.

In the case assumed of their use in the Chesapeake Bay, which was advocated at one time as a place requiring such defense, how many of them would be required to prevent the entrance of a war fleet? It is frankly admitted that the mouth of the Chesapeake is indefensible otherwise. Can it be assumed that one vessel of such a type in view of its slow firing battery, or rather, weak intensity of fire, can be matched against more than two battleships? The floating battery may retire into shallow water, but wherever it can hit it can be hit, and the shallow water will not prevent torpedoes from reaching her, if she is hotly engaged with two or more vessels. It has been suggested that she might retire behind the works at Hampton Roads, and that no fleet would dare proceed up the bay leaving two of them in its rear? What is the difference between fighting them going in or turning around and fighting them if they approach from the rear?

Another point suspected before, but fully developed by the English manouvres of 1892, was that the coast-defense vessels required the almost undivided attention of the coast-defense torpedo-boats for their protection. The rôle of torpedo-boats is well known now, and generally acknowledged to be principally in coast and harbor defense. If they are protecting floating batteries they have lost their character. It is not inaccurate to state that coast-defense vessels are more exposed to torpedo attack than any other class of vessel. The defense against such an attack lies in great mobility and an intense rapid fire. The first of these is not claimed in them and the last is totally absent. If separated for any reason from a base, their extremely limited coal-supply will be rapidly exhausted through the use of mobility forced upon them in the presence of torpedo-boats and vessels. At anchor or in the vicinity of an enemy, they will require all the paraphernalia to guard against torpedo-boats—nets, obstructions and mines—that are forced upon any vessel so situated, and just by so much are the other defenses

weakened. As batteries, the defects and limitations of ships are placed upon them; and as vessels there are imposed upon them also some of the defects of batteries in the quest for invulnerability. Unless accompanied by colliers, the coal-supply of monitors generally is too limited to admit of any great radius of offensive action away from their own coast. During the Spanish-American War two of them accompanied the United States squadron to Porto Rico early in May, and for portions of the distance they were towed by other vessels in order to avoid frequent coaling, thus diminishing the speed of the squadron. The outward and return runs were thus made slower, and had the Spanish Admiral not been hampered on his voyage from the Cape de Verdes by his torpedo-destroyers, which also required towing, he might have succeeded in reaching Havana while the one squadron was at Hampton Roads or en route south, and the other returning from San Juan. The monitors were considered as "very inefficient" for off-shore or distant work, due to their inherent qualities.

There is the case of their action as partaking in the defense of a fortified harbor. It is probable that from their mobility they might take positions of great tactical value, undoubtedly such positions will be at different points during the progress of an engagement. It can be imagined, however, that a skilfull enemy might use them as a cover, two of them might engage one closely, thus paralyzing the fire from the works. Their position will be limited to supporting distance of the works, otherwise they might be cut off; for the same reason they cannot follow the enemy where they would sacrifice the advantages of their light draft. If permanent defenses are not sufficient to deter or forbid an attack, one or two floating batteries will not; and in building vessels for coast defense, in the narrow sense, there is no doubt that the line of battle is just so much weakened. When all is said for and against them, there remains the fact that they may possess an undeniable value in their field of action. The question is as to the relative prominence to be assigned them in a naval policy. Torpedo vessels, dynamite vessels, gunboats, rams, and submarine vessels may be classed as coast-defense vessels, in the narrow sense, in addition to monitors. The submarine boat, the dynamite cruiser, and submarine gunboat may be regarded

as varieties of the torpedo-boat, as yet undeveloped, which may prove to possess what may be the vital requisites for coast-defense vessels—the possession in themselves of an undoubted superiority over an enemy—replacing with highly developed powers in one direction the ability everywhere to present greater numbers of equal types to the enemy.

Gunboats have found favor with all nations, and fill a double rôle. They can be used in shallow waters abroad, or in shallow waters at home—they are an essential in time of peace and valuable adjuncts in time of war. In our Civil War they proved invaluable. We have not given ourselves over to the policy of building armored gunboats as have other nations, notably the French, and there appear no good reasons for doing so. In coast attack a few of them are equal in gun strength to a large vessel, and possess greater mobility, at the same time offering a smaller target. Concerning them, a distinguished officer, Sir George Elliott, K. C. B., has said: "There can be no doubt that, in future wars, shore batteries will have so far obtained superiority over ships that close engagements will be avoided by the latter and that bombardment at long ranges will be resorted to where it is deemed operative, in which mode of attack a flotilla protected by ships will bear a conspicuous part."

He holds that the gunboats would stand their ground in defense in shore or under the protection of their batteries, and should maintain their position end on. They should be stationed in different ports ready to concentrate, and should be manned by volunteers. He dwells upon the power of these vessels to assume the offensive as suggested above in flotillas. "If a gunboat flotilla had been sent with the fleet to Cronstadt (referring to the first expedition to the Baltic during the Crimean War) the north passage of that island might have been cleared of obstructions, and a sufficient force have gone up to St. Petersburg to have dictated terms of peace. . . . Some efforts were made on the spot to improvise a flotilla force by mounting guns in harbor craft . . . captured for that purpose, but it was too late that year, and the following year, when some gunboats accompanied the fleet, the Russians had found out their weak point, and by taking locomotive engines off their railways, showed front with twenty-seven gunboats mounting heavy guns

against about half that number which England had provided. . . . When too late, some one hundred and twenty gunboats were produced."

He claims that torpedo vessels alone are not able to prevent distant bombardment, and that the tactics of the gunboats would be dispersion, a frequent change in range, and retreat into shoal water. The torpedo vessel is a recognized element of coast defense, and it is confidently believed that its full value has not been developed at the present time. The torpedo itself has become a new weapon since its range has been doubled, while its accuracy has become marvelous, and it cannot be doubted that these facts will bring about an entire revision of our idea of the weapon, its tactical development, and its place in maritime warfare. Other floating elements of coast defense are not touched upon in these pages, as they may be considered to be in the experimental stages. It is a wise government which spends money freely in fostering and in developing the warlike conceptions brought to its notice, where such conceptions appear to possess merit, for if worthless, they are easily exposed under governmental inspection.

We must not look to see the art of naval warfare so revolutionized at once that the force inferior in sea-keeping battleships will, with the aid of exceptional vessels unfit to take a place in the battle line, reverse the natural and historical order of things. Although such vessels may enhance greatly the difficulties which the force attacking a coast must encounter.

Several years ago the French ships Amiral Duperré and Sfax carried out some experimental firing against a specially erected fortification on the "Ile de Levant," in accordance with an agreement arrived at between the navy and war departments.

"The Amiral Duperré and Sfax had each been directed to carry out several series of firing, during which the course, the speed, the end to be achieved and the nature of firing were changed, each series occupying about three-quarters of an hour. During the experiments, which lasted altogether six hours, more than 1000 shots were fired from guns of 34 centimeters, 16 centimeters, 14 centimeters, and 10 centimeters (13.3 inches, 6.2 inches, 5.5 inches and 3.9 inches), which works out a little over two shots a minute per ship. A certain number of shells were filled with melinite. As it was necessary to examine the effects

of the fire after each series, the experiments had to be spread over a period of three days.

"The fortifications consisted of two batteries constructed by the engineers after the most approved fashion, and in which were represented very accurately, by models and dummies, the guns with their gun detachments and accessories. In each battery was simulated an armament of eight guns, four of heavy and four of medium calibre. One of the batteries on the slope of the island had an altitude of 65 feet; the second, crowning the crest of the island, had a command of about 328 feet. More than half the dummies of the gun detachments were hit, and about one quarter of the guns were dismounted or more or less damaged. The harm done to the forts themselves was insignificant, both from the shells filled with melinite and those filled with black powder. The melinite shells, which burst into very small pieces, would have been particularly deadly to the personnel. Some fragments were found at more than 1000 yards from the batteries, proving the enormous initial velocity produced by the explosion.

"Attention might be called to the advantage that forts possess in being able to draw on a practically unlimited supply both of men and ammunition, and also that the defense would continue as long as the work is tenable and a gun remains fit to fire. To dismount a few guns and put out of action a fair number of gunners (who could be replaced from others held in reserve), it is estimated that the Sfax and the Amiral Duperré found it necessary to fire 39 tons weight of projectiles. During the last Continental War, it was calculated that for every man killed, his weight in metal had to be fired, but the experiments under consideration not less than nine or ten times his weight in metal was required to remove one man of the defense. Such are the disadvantageous conditions under which ships are placed when contending against well-constructed fortifications. If, on the other hand, we suppose that the sixteen guns which served as a target had replied to the fire of the Amiral Duperré and the Sfax, we may presume that the two vessels would have been several times hit and have received some serious damage. A single shell of 240 millimeters (9.5 inches) fired from the commanding position of the battery on the crest would have been most dangerous to the armored decks, and in any case would have produced destructive results."

The feature of mobility for the armament of shore defenses so strongly urged by some engineers, is one which appears upon investigation to be highly desirable. In such a harbor, for example, as New York, on Staten Island, Long Island, Coney Island, or on Sandy Hook, a little extra preparation of cars for transporting guns would enable moderate sized ordnance to be moved from place to place where mounts had been established with the necessary cover and invisibility, and the system should be very perfect. Experiments have been made in India in firing guns from ordinary platform cars without much preparation as regards the trucks, and at all angles with the track. The commission charged with the experiment concluded that specially built cars on ordinary rails could easily support the firing of 6-inch guns. The gauge was 3 feet 4 inches, and the rails were not reinforced in any way. The 81-ton gun has been fired on rails in England, and there seems no reason why an ordinary truck might not be specially prepared to take such carriages. It seems also a most important requirement for coast defenses that there should be a ceinture railroad in connection with them, just as such a system of rail communication is deemed of such vital importance in national defense, to provide rapid movement to the threatened points of bodies of troops. The demands of trade and intercourse in this country have produced a system almost perfect throughout the country without having had recourse to the construction of so-called military roads as in other countries.

The advantages of the ability to move ordnance from one point to another, in addition to the transport of troops to a threatened point, and the supply of ammunition, are too obvious to need much attention. In case vessels concentrate their efforts on one point, such mobility on shore enables a concentration to be made to meet it. If the range or location of a light battery is so accurately known as to make its position untenable, it can be abandoned for another location should the rapid-fire guns have rail carriages designed for them with this object in view. A distinct advantage possessed by rapid-fire guns on shore over those afloat is to be found in the opinion expressed by makers of such guns, that not being limited by space for guns or ammunition, it is practicable to give the guns any desirable length. Canet has put forward tables for guns

up to 100 calibres in length. While the increase in the rate of fire of rapid-fire guns is equivalent to an increase in number up to a certain limit, the number of rapid-fire guns for coast defenses need not, and should not, be restricted. The ability conferred by steam, enabling vessels to run rapidly out of one zone of fire, should be met by an increase in the number of guns and their own power of motion.

Another important element in harbor defenses is known as vertical fire, and the indications are that it will possibly take a preponderating importance in future coast warfare. The use of shells in vertical fire long antedates their use in so-called shell guns.

The first reference to such use in bomb vessels goes back to the siege of Algiers in 1685. It was the suggestion of a Mr. Reyneu.

In the wars of the last century, mortars and howitzers were freely used, but almost altogether in the attack upon fortified positions, and such has been the case even down to the present. The reason probaly lies in the fact that the fire was considered so inaccurate that it was deemed effective only against works offering a large superficial area.

The value and importance of mortar fire in the Civil War was fully appreciated, and, since that war, both in Europe and this country, successful efforts have been made to develop all the possibilities of vertical fire, until now in its particular applications to coast defenses, engineers the world over are able to say that vessels cannot anchor in order to carry on a siege while exposed to the fire of properly installed mortar batteries.

In a valuable report made by General Gillmore after the siege of Fort Pulaski, at the mouth of the Tybee River, an interesting idea is gained of the estimate placed upon mortar fire at that time. The siege took place in 1862, and great disappointment was felt and expressed regarding the performance of the mortars of 13-inch calibre, for although the circumstances were peculiarly unfavorable to the mortars, the net result was that not one-tenth of the shell from the mortars fell within the work, which was a pentagonal work of considerable size designed to mount 140 guns. The 13-inch mortars were fired at ranges between 2650 yards and 3400 yards, such ranges then being considered too great for effective work.

General Gillmore concluded that mortars were unreliable for the reduction of good casemated works of small area, and believed they could play an important part in the reduction of a work with wooden buildings which might be set on fire, or in silencing barbette batteries. In addition, he recognized their value for the reduction of fortified towns and cities, but suggested that rifled guns fired with high elevation might be better suited to the work. This opinion was a keen forecast of what has since been accomplished in the development of mortars.

If we look at the causes of this poor practice, it is not quite clear why any disappointment should have been felt. The mortars were placed after almost superhuman efforts on soft ground, on improvised platforms, which, however, behaved better than could have been expected. The powder used was reported as being defective, and there being no standard copper measures, it was weighed out in tomato cans. No one thing affects mortar fire more disastrously than inequalities in the charges of powder used. The gunners had never fired before, the wind was entirely unfavorable to the practice, and owing to the length of flight this was also a very serious disturbing cause. Some 10-inch mortars, ranged at 1650 yards for some reason, gave far better results, dropping something less than one-half their shell inside the work, the total number of mortar shells fired having been 1732. Evidently too low an estimate was formed as to the accuracy of mortars in this case, or else too much was expected of them under the circumstances.

Many experiments have been carried out to develop and test this class of fire, principally at Meppen, though the Russians, Italians and Japanese have been very active in experimental work. The majority of the experiments, however, have been carried out with a view more to test and secure penetration of the projectile through targets representing the protective decks of existing types of vessels. The desire appears to have been to secure penetration through the deck before the explosion took place in order that the machinery, or magazines, or other vital points might be struck or destroyed; some even having looked to the penetration or destruction of bottom plates of the vessel or of the propellers or the rudder. Some experiments carried out at Meppen in 1879 were interesting in themselves both for the accuracy shown to be possible at that time

and from the rigid mathematical analysis to which the results were subjected. The commission reported as follows: "From all this we think it may be concluded, if the probable errors which may be met are considered, that the probability of striking the deck of a vessel with curved fire is, notwithstanding the great accuracy obtained, pretty limited for large distances and rather large for distances between 2187 yards and 3281 yards. Remembering that many guns may at once be fired against a vessel, and considering the effect that a single heavy projectile may produce in the vital part of a vessel by striking its deck, we can but feel the necessity of opposing an efficient resistance against curved fires, which are, without doubt, sufficiently serious to a fleet that desires to act against a coast."

Captain Barabino, of the Italian Artillery, taking up the question here, says: "It remains to consider the probability of hitting with curved fire a vessel which moves in any direction with a given velocity. I do not think that in a real attack against a fixed object in which many vessels take part they can manoeuvre with a velocity approaching that of their ordinary movement. They are prevented in their evolutions in the midst of smoke, and in a relatively small area by the wish to maintain their proper distance of fire; and to prevent collision, an occurence that is more probable the greater the number of types of vessels, the nearer the shore, and the greater their radii of evolution is. Yet it is necessary to admit as possible that a squadron may carry on a bombardment keeping up a velocity of about six miles, and this velocity, by which a vessel displaces itself during the time of flights of projectiles, has an injurious effect upon the probability of hitting."

The results as given by vertical fire from the French 22-cm. howitzer for ranges up to 4000 meters, and from the curved fire from 24-cm. Italian guns up to 9000 meters, were subjected to analysis on the theory of probabilities, the conclusions being expressed thus: "In other words we can admit the probability of hitting with shell curved fire from the 24-cm. rifle up to 9000 meters will not be less than 2 or 3 per cent, when we take for a target the deck of a vessel moving with a velocity of six miles an hour. The results, which at first view seem poor, do not seem so when we consider the condition in which a squadron is relative to a coast battery while at such a distance away,

that it cannot harm it, and consider the immensely destructive effects that a successful shot from the shore may produce on the vessel struck. The expermients on the Guerriera . . . . make it probable that two large projectiles which burst after penetrating an armored deck would be sufficient to make the vessel withdraw from action; and the withdrawal by one vessel of the squadron and the incessant rain of heavy projectiles against the one or more still remaining seem sufficient to demoralize the crews. As in a battle on land, a tactical unit is considered disorganized when it has lost from one-third to one-fourth of its strength, so I believe that an attacking squadron would cease bombarding if two or three of its vessels were forced to retire by the curved fire of seacoast artillery."

The results of experimental high-angle fire as carried out in England have not been accessible to the writer.

An English author, however, an engineer, says concerning the early experiments with the 9-inch polygrooved gun, muzzle-loader, that " They were remarkably successful and proved that, thanks to the position finder (Watkins), it would be impossible for a ship to anchor at 8000 yards from such guns without receiving frequent deck hits of a dangerous nature. Even against a ship in motion the chances of obtaining such hits are considerable, and it may be taken as established that no vessel afloat would dare to remain under the fire of small groups of these guns."

In 1891 the Japanese made some experiments for penetration and fuse action, against a target representing a section of the protective deck of one of their new vessels. The accuracy was not remarkable, twenty per cent of hits being scored against the whole extent of deck, the range having been 3773 yards. Former experiments at Bucharest gave a percentage of hits under similar conditions of 22 to 23 per cent.

All these experiments and many others have been made under peace conditions and under the most favorable terms, while others have been made especially at Spezzia, at moving targets which appear to have been very successful; at any rate, the Italian coast as a result of these experiments is well provided with howitzers and their mounts.

Concerning the accuracy of vertical fire, it is proper to note that the size of the rectangle made in any stated practice de-

pends upon the nicety of the mechanism of the guns and carriages; upon the regularity in the charge and projectile, and upon the proper estimation of range and correction of the incidental errors due to the wind, barometer and time of flight. From the character of a high trajectory, it becomes the more important to have the most accurate determination of the range on account of the short danger space, which is little more than the length of the target in the plane of fire. The time of flight requires careful allowance for deviations caused by wind and change in the location of the target; the fact that the errors in high-angle pointing are exaggerated over those in direct pointing, requires either the nicest mechanism or the multiplication in the number of mortars. It is evident from the few experiments referred to with mortar fire that, should the elevation and other factors remain constant throughout a string of shots, the rectangle enclosing all the hits will not be so very large. In the use of vertical fire in sea-coast defenses, the vital point is to be able to place the rectangle where it is wanted, and to accomplish this an efficient system of range and position finding is absolutely essential, as well as absolute uniformity in powder. On shore there is no limit placed upon the application of range and position finders. The stations can be in the most favorable locations, observation points where wanted, and the communication with the gun can be made in any manner desirable. There being no occasion for any exposure whatever of mortars, there is no reason for their dispersion, and by grouping them they can be pointed and treated as one mortar under the direction of one officer. The individual rectangles can thus be made to overlap and supplement one another. There is a concurrence amongst engineers, both English and American, in limiting the number of mortars in a group to four. It is further desirable to assemble a number of groups to make an overlapping of the group rectangles, the disposition of such groups depending upon the results of experimental practice in making rectangles. There is also a concurrence in assigning four groups of mortars to a battery—thus the number of mortars in such a battery will be 16, subject to the direction of one officer and avoiding a multiplication of communications of ranges, which could only be confusing. Mortars being comparatively cheap, can easily be so utilized as regards numbers

as to eliminate most of the chances of not hitting. This merit of cheapness is a further argument against the use in mortars of armor-piercing projectiles of great cost. Ammunition should be unsparingly though intelligently used to gain the full effects from mortar fire. It is calculated that, to ensure penetration of existing protective decks with the larger sizes of mortars, the ranges are found to be between one mile and something over five miles. These are sufficiently wide to allow all the latitude desired in the selection of sites for mortar batteries, apart from the consideration that penetration of the protective deck is not the only essential. From considerations of the fact that if mortars are placed at a high elevation they gain almost twice that elevation in the velocity due to the fall of the projectile, some engineers have been lead to advocate high sites for them; but as high sites wherever available should be utilized for the main armament of guns furnishing horizontal fire, and as the one armament should not be exposed with the other, it does not seem important that mortars should be placed on high sites, though it is certainly desirable. Mortars finding their best sphere of action at the greater ranges, fill exactly the weak place in horizontal fire against armor, besides, as it were, turning the flank of the armor. They do not in any way take the place of horizontal fire directed against unarmored portions of the hull of vessels, which fire is effective at all ranges.

If the mortar batteries are near the shore line with a deep-water channel close in, there will be a point about one mile distant where the elevation will have to be so great in order to procure sufficient velocity of fall, where the inaccuracies will also be increased, and where there is a chance owing to the extreme elevation that the projectile will fall base first that it will be necessary to discontinue their use at that range, and to turn them again upon such vessels as happen to be at the outer ranges. If the mortar batteries are retired, or there is shoal water in their front, ships may be under their fire continually. By retiring the batteries and studying the shore line, it may be possible to make them serve the double purpose of operating over the water approach and over possible neighboring anchorages, which might otherwise be occupied by hostile vessels.

In narrow entrances where vessels may pass at speed on a

chord to their arc of fire, their use is not indicated. If they must pass on the arc, the mortars would then be at the extreme of their usefulness. In such passages, if the batteries can be located at varying distances, sufficiently great, on or near the prolongation of the passage, they would fill a part which could be filled by no other character of guns; and if the conditions of the passage render navigation difficult, or if it be obstructed, they could almost certainly forbid the entrance.

Yet another tactical use for mortar batteries well withdrawn suggested by a French naval officer, is to cover the dead angle in cases where the character of the coast requires direct firing batteries to be mounted upon a height. Mortar batteries properly dispersed could drop their shell over just that position of the water front uncovered by the direct firing guns.

The seacoast fortifications of the United States have undergone several well-marked stages of development, limited generally, as can be imagined, to the eras succeeding war; the time preceding the War of the Revolution, and during its continuance, producing what has been termed the first system. It comprised light works of little value, and included all the works projected or actually built at that time. The second system comprised the works built under appropriations made prior to the War of 1812, and are described by competent authority (General Totten) to have been, while numerous and widely distributed along the coast, " small and weak, being built for the sake of present economy, of cheap materials and workmanship, were very perishable."

Subsequent to that war, the moral having been drawn from the experience beginning with 1816, the government proceeded regularly with the work of the building up of the harbor defenses. Appropriations were forthcoming, the work of construction went systematically along, under a well-developed scheme, which was only interfered with from time to time by Congress. A statement in a report made by General Totten, Chief of Engineers, throws some light on the tendency of localities to claim precedence to the detriment of any well-devised plan, as follows: " The order has been well observed generally in the execution of the system with the exception of some cases in which, by the action of Congress, certain facts were advanced out of the order advised by the board."

This interference seems to be an evil inherent, and unavoidable, not alone perhaps in our institutions, but with us it may be attributed to the wide extent of the country and the consequent apparent separation of the interests of localities. There is reason to hope that a better era has long since begun.

During the progress of construction of the third system of harbor defense—the one that has existed down to the present day—upon occasions where engineers had to do with sites calling for dockyards or naval depots, naval officers of rank have been associated with them. This system furnished the harbors and points on the frontier with numerous strong works, generally of masonry. Command of batteries was not deemed important, the advantages flowing from the use of ricochet fire with smooth-bore ordnance outweighing other considerations. Thus the fortifications were placed mostly à fleur d'eau, while land forts were provided to enable a siege in rear of moderate duration to be sustained, and in some cases to withstand a very extended siege. It was recognized that masonry was not sufficient to sustain fire from siege guns on shore, consequently earth was placed upon the land fronts, but masonry was deemed sufficient against the inaccuracies and limitations imposed upon the guns of the day when afloat.

In consequence of the effort made, the harbors of the coast were placed in a remarkable state of defensive efficiency for the smooth-bore era preceding the Civil War; but during that war, however, the larger calibres of smooth-bore guns and the use of rifles demonstrated the inadequacy of masonry casemates. Some of the works while remarkably fine examples of the art of the engineer, seem to have gone far beyond anything that the circumstances of the day of their design, or any other day for that matter, could have warranted, and illustrate finely the intermittent liberality of Congress. Their construction was justified perhaps by the apparent urgency of the time, which resulted in the calling to the assistance of our engineers the aid of French engineers. In the fifteen years succeeding 1860, the system was developed on the same lines, being an outgrowth and enlargement of that system, but about the year 1875 appropriations ceased and were not again made for seacoast defenses until the year 1890, when appropriations were resumed and have since been expended in modernizing the system.

The objects which the engineers had in view in the development of the system called the third system can be stated best in the formal language constantly used for many years in their official reports. They classed in relative importance the means for defense as, first, a navy; second, fortifications; third, interior communication; and fourth, a regular army and well organized militia. The objects and purposes are stated thus: "The navy must be provided with suitable establishments for construction and repair; stations; harbors of rendezvous, and ports of refuge, all secured by fortifications defended by regular troops and militia, and supplied with men and materials by the line of intercommunication. Fortifications must close all important harbors against an enemy, and secure them to our military and merchant marine. Second, must deprive an enemy of all strong positions where, protected by naval superiority, he might fix permanent quarters in our territory, maintain himself during the war, and keep the whole frontier in perpetual alarm. Third, must cover the great cities from attack; fourth, must prevent, as far as practicable, the great arms of interior navigation being blockaded at their entrance into the ocean; fifth, must cover the coastwise and interior navigation by closing the harbors and the several inlets from the sea which intersect the lines of communication, and thereby further aid the navy in protecting the navigation of the country; and sixth, must protect the great naval establishments. Interior communications will conduct with certainty the necessary supplies of all sorts to the stations, harbors of refuge and rendezvous, and the establishments for construction and repair, for the use both of the fortifications and of the navy; will greatly facilitate and expedite the concentration of military force and the transfer of troops from one point to another; insure to these also unfailing supplies of every description and will preserve unimpaired, the interchange of domestic commerce during periods of the most active external warfare." As this presentation exhibits the objects to be attained by coast defenses so far as effected by fortifications and organization, it will perhaps be well for future reference to state them more tersely. The first clause, so treated, states that naval arsenals should be secured for the service of our own navy. The second means that no place shall be left uncovered by fortifications where a hostile force under cover of naval

superiority could gain a foothold. The third refers to interior communications in their relation to the logistics of the question.

In general, harbors or ports derive a military importance, which is strategic, from their location considered with reference to their location on the national coastline; to their location relative to the strategic points of a foreign coastline, their relation to interior strategic centres of support, and they have an importance of their own tactically considered. Strategic considerations alone may determine that a point deficient in tactical possibilities should receive full development, for instance, such a point as Cherbourg in France, or Key West, or Tortugas, perhaps The Race off New London. This, while true of the positions on the mainland, is especially true of insular positions.

Naval arsenals imperatively demand permanent, natural, or artificial defenses of the first order, otherwise there is little or no reason for their existence; we would simply have built for others, the question so far being simple, as long as we are inferior at sea. In the selection of such points for the construction of arsenals or navy yards, every strategic characteristic should be carefully taken into consideration, and at such points so selected we should expect to find a remarkable combination of properties. Generally speaking, the requirements for such positions contemplate, first, as regards their geographic location, that they should form advantageous bases for naval operations. This requires a careful consideration of our own and foreign trade waters; the location, distance and direction of foreign bases of operations; and the geographic relation the position holds as regards the mouths of rivers, other great ports, and harbors of refuge. Some positions fulfilling perfectly these qualifications are yet lacking in other essentials which go to make a site for an arsenal, suitable in all respects. The harbor selected must offer a depth of water suited to the heaviest vessels seeking it, the currents or tides must also be moderate and advantageous, and the water must be of enough depth along a sufficient frontage to admit of wharfage for any number of vessels likely to need it. The place selected must furnish sites for the heaviest buildings and be suited for the construction of dry docks, labor must be plentiful and easily attainable, while supplies of all kinds and good water should

be at hand. Manufactured products and raw material of the necessary descriptions should also be convenient, and free and easy communication with the interior and other centres is indispensable. The climate should favor health and labor, and lastly the position should favor easy defense and be tactically good.

As a general rule only great cities at the exits of great water routes fulfill all these conditions, while the same combination of qualities is rarely characteristic of other localities except in new territories, where it happens that in providing naval arsenals with fortifications many other objects will be fulfilled. In addition to the arsenals, the great cities will be freed as far as may be from possible insult. The pivotal points on the seaboard of the great interior and exterior carrying trade routes will be secured, and the natural bases for naval operations for offense or for concentration will be held for ourselves as against possible enemies. Should the site not comprehend all these features, it will yet be a point from which to strike the enemy, and should include as many of the requisites as possibly can be secured. The following places then can be disposed of as requiring fixed and mobile defenses of a high order: Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; San Francisco, Cal.; Philadelphia, Pa.; Norfolk, Va.; Washington, D. C.; Port Orchard, Wash.; Port Royal, S. C.; Key West, Fla.; New Orleans, La. The character of these defenses should be modified or proportioned according as the draft of water permits them to be subjected to a greater or less attack. Portsmouth, Hampton Roads, Key West, San Francisco, and Puget Sound are exposed to an attack by vessels of any draft. Boston, New York, New Orleans are exposed to close attack by vessels of a less draft than 26 feet. Philadelphia, Norfolk and Port Royal are exposed to an attack by vessels of a less draft than 23 feet. Washington to an attack only by vessels drawing less than 20 feet.

It is perfectly certain that permanent defenses having been provided covering these points upon which the navy depends for its existence, that the work should not stop there. The question then arises, granting that all vulnerable points of the enormous extent of our coastline cannot be liberally protected by permanent defenses, what points shall be afforded such pro-

tection and to what extent? It is a great question to answer which requires an equipment of ability and study of the particular subject belonging peculiarly to but few people. The task cannot be attempted here other than the suggestion of a few propositions. There are strategic points independent of those mentioned, and there are numerous coast cities and towns of all degrees of wealth, importance and accessibility. There is the idea of reserving certain harbors for our navy and belated merchant shipping while refusing them to our enemy. To repel or forbid an attack in force, the permanent defenses should be of the highest order, while to repel or forbid a raiding attack, they need be very slight. Cruisers can be deterred from attacking, or can be repelled in attack, by a few guns judiciously placed and covered.

There is a tradition that for the protection of coast cities the works should be proportioned to the wealth to be covered. That for a city representing so many millions of accumulated riches the works should be of such and such a degree of magnitude, that for a city representing half that value the works should be of a strength or value of one-half as much, in other words, the cost of the works is a per cent of the assessed value covered. It seems that this establishes inherently a false standard, for will the attack proportion its offensive strength on any such assumption? It would seem more rational to assume then that there are but two degrees of strength to be given to defensive works. One, as against an attack in force—the strength of the attack depending upon the accessibility of the place to be protected, in the matter of depth and area of the water approach—the other as against a raiding attack by cruisers. An intermediate degree of strength would be contemptible against an attack in force, and overwhelming and costly against cruisers. It would also seem a fair assumption that places which could be bombarded by vessels from situations comparatively free from danger—that is, such places as are directly on an open coast—should not receive any protection from permanent defenses, for the resistance offered by such places surely draws upon them the hardships of war. Their peaceful character in the absence of such resistance is the best safeguard—Admiral Aube to the contrary—the weight of experience and civilized opinion being all against the bombard-

ment of peaceful towns. To assemble further some conclusions that may clear the air in this most intricate question, it is suggested that landings cannot be prevented, for an enemy can always get a footing on the coast where unprotected if the naval strength falls below a certain standard; and further, that permanent defenses can do nothing beyond refusing an entrance in certain places to a hostile squadron—defenses cannot raise a blockade, and they have no influence beyond the area covered by their guns. This last proposition needs perhaps further elucidation. There is no danger to a fleet involved in the fact of having fortifications in its rear. Seacoast defenses do not threaten an army of invasion passing them in rear, in the sense that a fortified strategic land position threatens an army passing it and leaving it in rear, unless the seacoast defenses shelter a larger garrison or an army which is not contemplated. If the works shelter or promise to shelter a defensive fleet, an attacking fleet would be obliged to pause and deal with that fleet; but it will be observed that as in a land fortress, it is the mobile force, the army, that constitutes the check; so in the seacoast fortress, it is the fleet that accomplishes the same object.

The northeastern section of our coastline from its extreme boundary to New York, offers a continuous line of harbors, accessible at all seasons to vessels of all descriptions. Winter gales and fog but enhance the difficulties of the navigation of the coast waters, without materially altering their favorable character for naval operations in the case of steam vessels. From Cape Ann to the eastern boundary, no section of the coast is characterized by features differing from those presented by any other section of the same stretch. The coast city of the greatest value, Portland, has been the point deemed most worthy of treatment in the way of defenses. The wealth of the place and superb harbor have heretofore indicated it as the point for our strongest flanking defense in the North Atlantic. To-day no permanent works can cover or shield the city as vessels from positions of perfect safety to themselves can bombard the city. Fortifications probably can refuse the harbor to an enemy who, seeking a base on that coast, can choose amongst the others. What object, then, will the fortifications of Portland secure? The city and the shipping may be shelled by cruisers even, or the

ransom will be paid, but the desired resting point for the navy will be preserved. The strategic points threatening the adjacent coast and the trade routes to the southward are better watched from points to the westward of Cape Cod. Is Portland the fit point? This is a question that may be examined from two different standpoints. One wholly naval and connected with maritime operations only; the other and broader aspect considers the combined operations, naval and military. As fortifications at that point do not secure any safety to the city from bombardment, the reason for their existence must depend upon other considerations. As the possession of that one particular harbor over any other neighboring harbor is not essential to the purely naval operations of an enemy or of our own, we must look still further for reasons. In this long stretch of important coastline there must be some selected point as a base for our own naval operations, which shall be centrally located and not so far removed from the extremities as to hamper or forbid their support; just as circumstances of distance compelled the early occupation of Port Royal in the Civil War. The enemy may choose his base, but he must feel in case Portland is not taken that next door to him there is a menace. There can be no dallying with it nor passing it. It must be reduced as a preliminary to further movement. From that base he may be struck at any moment, and while that naval base exists the enemy is compelled to put forth great efforts for the security of his own, whether it be established on our territory or whether it be already in existence on foreign territory. A military writer, Lieutenant-Colonel Wagner, has pointed out most forcibly the extreme disadvantage under which we are placed on that portion of our own boundary, both from natural and artificial causes in case of a contest with our neighbor on that side. After a convincing argument tending to show most surely that in such a contest our most feasible and important objective for military operations would be Quebec, with Montreal as a preliminary objective, both by way of the old historic line of operations through New York State, he calls attention to the ease with which the enemy could create an important diversion and place his grasp upon a vital point of our soil. A glance at the chart will make his meaning clear. An army of invasion proceeding westward across the boundary

encounters no obstacles other than a few rivers, which are not insurmountable. If this enemy commands the sea, his left flank is securely based upon the fleet, and his communications are perfectly safe, being threatened from no direction. When the Kennebec is reached, his grasp is upon the old line of operations, the communications between the sea and the St. Lawrence. If the situation be reversed and we attempt an eastward movement, the peril is at once apparent. All the lines of communications are assembled within thirty miles of the sea and are open to attack from the enemy's fleet, and if the enemy's fleet possesses itself with a harbor well to the westward, say Portland, and entrenches himself, his purpose is nearly accomplished at one stroke. Reinforcements and supplies can be poured in from the sea, and without the reduction or masking of Portland from the side of the land, our communications are at his mercy, and no operations eastward can be made in security. Thus the weakness of our position is at once apparent. If Portland be strongly fortified (the plant is already there) and a naval force in existence, the advantages in the enemy's favor are largely neutralized. The key of the situation—the binding point of the land and naval forces—is secure. The enemy may advance by land and sea, but his fleet, or a portion of it, is tied to his left flank, and at some point he must stop, and contend the ground squarely. His continuance will ultimately rest upon his naval success, and in case of failure the conditions will be reversed while the advantages of the re-entering base will rest with us. One of the vital links in our chain of defense is certainly a point fitly chosen and properly fortified, and because Portland is a great city with a fine harbor for all classes of vessels; because it already has the sites and beginning of the plant; because it is near the north and south line of communication by the Kennebec Valley; and because it is a collecting and distributing point of the coast and interior, it would seem to be the fit point, although some of the tactical conditions which formerly pointed to it as the one point on the coast to be fortified have departed under modern development. Such other points on this section of the coast, entrances to harbors, mouths of rivers, harbors of refuge, should be provided with a slight defense, any serious attempt to occupy them by an enemy should not be resisted by passive defenses, for the attempt woul be futile and the results disastrous to the place.

The St. Croix River, forming a portion of our eastern boundary, empties into the Pasamaquoddy. The conditions are such that the American channel of approach (Lubec Narrows) is the poorest of all. It is full of shoals and five or six feet deep at low water. Great Britain possesses a much better entrance, thus everything facilitates the English control in war of that bay upon which Eastport is situated.

The section of the coast beginning with Cape Ann and extending to New York is probably the most remarkable of the whole Atlantic coastline, and, together with the reach to Cape Henry, it constitutes the sea frontier of the most important section of the country. It is the centre of the possible theatre of Atlantic coast warfare, the extreme flanks resting upon Maine and Florida. It can be more readily supported than either, and at the same time covers the greatest interest. Generally speaking, its physical characteristics are intermediate between those of the northeast and the southwest. The capacious harbors are less frequent than in the northeast and the question of seacoast defenses is in so far simplified.

Boston, the engineers assure us, can readily be placed in a state of perfect defense. About Massachusetts Bay and Cape Cod many strategic possibilities hinge, but nature has there provided that man cannot improve on her works. Any part of the estuary within the cape is an anchorage for a steam vessel. The cape itself is incapable of efficient passive defense. These circumstances remove the section from our sphere of discussion, except that attention is again called to the preponderating importance of a navy. Beneath the cape is the remarkable group of islands and sounds through which, or around which, passes all of the coast trade that does not find a terminus in Narragansett or Buzzards Bay. Owing to the physical conditions the region is incapable of artificial passive defense. The intricacies of navigation and the insufficient depth alone must be relied upon to embarrass an enemy. In the sounds he can readily establish himself unhindered by us except through the intervention of a naval force. The same is true of Buzzards Bay. Passing over the minor resting points of the coast, Narraganset Bay is the next break in the coast demanding attention. Fixed defenses at the main entrance with obstructions and flanking defenses in the eastern channel may interdict an entrance to a

moderate force. They cannot save Newport. They may save Providence, Bristol, and Fall River from a cruiser attack, but it is questionable, as before stated, if those objects cannot be better secured in another manner. The question then is a strategic one, the bay being remarkably placed in relation to other points of great importance and the mouth of the Thames River. A proposition before suggested seems to bear especially upon this point—that there should be no half-way treatment of the question—the defenses should stand against cruisers or against an attack in force. As a base for naval action, the bay of Newport is superbly placed, but in that respect it cannot take the place of a location nearer the mouth of Long Island Sound. If fixed defenses do not cover the town of Newport, if nothing is refused the enemy in that he can find other and better resting places uncovered by defenses, what then is the argument for fortifying the point, other than for the protection of Providence and other points on the bay? The rational answer would seem to be that it may be considered as the outpost for the interests ashore, which can also be protected by inner lines; that is, it forms a powerful link in the extensive scheme of defense devised for the eastern entrance of Long Island Sound.

The entrance to Long Island Sound comes next for consideration, and strategically considered it would seem to be one of the most important points of the Atlantic coastline. The desirability of protecting it by fixed defenses seems so obvious that the only real question in the matter would appear to be whether it is adapted to such treatment,—whether it is feasible to guard the entrance. The engineers assume that such defense is entirely practicable. Being the gate of the most important waterway of the entire coast, it is as well the outpost of New York on its most vulnerable side, and the question of fortifying it adequately involves works at the southern end of the line marking the narrowest parts; intermediate works, and a fortified base at New London. It is probable that the Long Island end from its physical characteristics cannot be fully developed, but in the presence of a fleet and the other supporting defenses it would be well nigh impregnable. In the absence of a fleet, the defenses should certainly be able to hold out for a time, until they could be relieved, and if there be no relief they might as well fall. New London harbor, at the mouth of the Thames,

the engineers also assure us, is capable of a high order of passive defense. It occupies in addition to its position on the defensive line a position relative to the sound analagous to that of Hampton Roads to Chesapeake Bay; that of Key West to the Gulf of Mexico, and to many strong points in foreign countries deemed worthy of the highest treatment. If the line of the entrance be forced, no enemy in his surely disorganized state would venture to leave a hostile naval force behind, sheltered under the defenses of the harbor. He could not leave it behind intact only as the base for an expected fleet. As distinguished from Newport, Block Island, Buzzard's Bay, or other like favorable locations for an enemy, New London gains greatly by being just where it is. The question of refusing any part of Long Island or of the Connecticut shore to an enemy bent upon a coup-de-main directed against the great interests at the bottom of the sound is purely a military one and no fixed defenses can prevent him gaining a foothold. The narrow entrances at the bottom of the sound to the East River are easily susceptible of defense and should be liberally treated.

No other section of our coast except possibly the Florida Keys, is comparable with it in military importance or interest. The holding of Long Island Sound at the two entrances covers the interests of three great states, New York, Connecticut, and northern New Jersey, and in holding the eastern end much will have been done towards the security of the coastwise trade, although that trade can only completely be secured by a naval superiority. It is stated that the commerce annually reaching New York through the Sound equals in value the total commerce entering by the Narrows. The strategic value of the sound to us or an enemy has been elsewhere referred to, and in our wars with Great Britain, the English fleets were fully aware of it and freely availed themselves of the large and commodious harbor offered by Gardiner's Bay. A modern fleet would find it a most advantageous spot for the transfer of supplies, and its simple occupation by such a fleet would disjoint almost the entire coastwise trade, placing the enemy in the most favorable position for naval operations of whatever nature. The proper fortification of the line crossing the entrance, in all that is implied, would involve works on Plum Island, Gull Island, Race Rock, and possibly on Valliant Rock.

Works on Gardiner Point in addition would interdict the only passage into Gardiner's Bay suitable for large vessels; the width of the passage here between Plum Island and Gardiner's Island being but two and one-half miles. The Race has a width of three and one-half miles with Valliant Rock in the centre, and is the only passage suitable to vessels of size. Works on the islands mentioned and the rocks, with submarine mines should deter an enemy from attacking. All the works besides those of New London, can be dispensed with in the sound, except those at the western end. At the entrance by the Narrows, defensive works should be placed at the Hook and Highlands; on the shoals in the lower bay, presumably Romer Shoals; Coney Island, and points to the eastward; on Staten Island on the southeast face; at the Narrows on Staten Island and Long Island, and at points above points which are favorably placed for mortars commanding the entrance. The lower works in covering the lower bay cover the immense interests of northern New Jersey in addition to gaining the great strategic advantage of holding the bay. The suburbs of Brooklyn, however, may be exposed to distant bombardment. Works of the highest order would seem to be demanded in the lower bay, but probably one of the best defenses against the entrance of vessels would be the removal of navigation marks and the judicious use of submarine mines. The works would still be needed, though our estimation of the magnitude may be sensibly diminished. For large strange vessels the navigation of the entrance is sufficiently intricate even now, and if an enemy should not be provided with pilots of the first order, he would be embarrassed in making the entrance. Foreign pilots for New York, however, can be assumed as with the enemy, but confusing marks may still hamper the entrance. Submarine mines and controllable torpedoes should be sufficient to stop him, if properly flanked.

It is interesting to recall the old works as they existed in the War of the Revolution and the War of 1812. In the first war they were placed at the corner of Catherine and Cherry streets, at Coenties Slip; the foot of Broadway, and on the hills bordering the Hudson. The principal works of our late Civil War were at Hell Gate, Castle Garden, Governor's Island and Bedloe's Island, the lower bay being open to whoever wanted it.

The next division of the coast from New York to Hatteras is characterized by few or no places which an enemy would or could make an object of attack, few places offering any facilities to an enemy. With the exception of the Delaware and Chesapeake Bays, there are no openings giving an entrance to vessels of any size. Fixed defenses cannot dispute an entrance to the mouths of either bay, or the occupation by an enemy of their lower sections. It would seem that at some fit point in the Delaware capable of being defended, that the progress of an enemy should stop. If the enemy reaches to Delaware City the interior line of communication is cut. Delaware Bay, we are informed, can be forbidden to an enemy without difficulty. In the Chesapeake conditions are somewhat different, and the question of fortifying no other point has been so warmly discussed as that of fortifying Hampton Roads. The location of the Norfolk Navy Yard is undeniably a superb one, and so far as fortifications at Hampton Roads tend to protect it, they are demanded. The location, while not entirely favorable, is yet such as to tend towards a formidable defense, and on the principle of keeping defenses in advance of the interest they are to cover, the point is well chosen. Because an enemy can turn them and threaten Norfolk by land on either side is no reason, as sometimes urged, why the passage for ships should not be guarded. As covering Norfolk, the works at Hampton Roads are demanded, and for other strategic reasons they are also invaluable. While in existence and covering a possible naval force, no enemy can proceed to execute any operations throughout the extent of Chesapeake Bay and its tributaries without first engaging that force or at least sealing it up and masking it. Harassing attempts can be originated and made upon him from that base, and if he cannot hermetically seal it, his whole action in the bay will be disturbed and perhaps prevented. A vital point in the interior commercial route is also secured by the defenses of Hampton Roads.

Baltimore and Annapolis should be provided with defenses proportioned to the attack—a comparatively light defense, we are assured under the conditions that obtain there, is quite sufficient. Fixed defenses in the Potomac cannot prevent a recurrence of the events of 1814-15. Light defenses, however, can prevent the passage of the only vessels able to use the river.

South of Cape Henry there are few sites favorable for occupation by a floating force. The character of the coast is very much the same throughout its extent to Florida Keys—low and sandy, with many minor breaks leading to the interior line. Outside of nearly every entrance is usually to be found a bar interdicting entrance except to vessels of light or the lightest draft. In the majority of cases light defenses supplementing the naval forces, torpedo-boats and gunboats in the interior waters would be quite sufficient to refuse passage to such an enemy as could attempt it.

Port Royal, admitting large vessels, demands treatment of the highest type, as, lying midway between the Chesapeake and the Straits of Florida, together with fortified points at the Mississippi, it repeats the system of coast fortification in the three strongly placed and fortified points of Venice, Taranto and Spezia, and it is further a naval station to which its strategic position gives great importance, the feature of outlying bases being faithfully repeated.

The vital importance of holding a point or points on our southernmost salient commanding the Straits of Florida, the great highway of commerce, will be appreciated when it is considered what the effect would be upon our commercial and naval movements should such points be abandoned to the enemy. The mere fact of such occupation would paralyze the former, while its effect upon the latter can only be imagined, for consider our fleets deprived of that base so vital to them even during the Spanish War. There can be little doubt that other enterprises undertaken by these fleets would be abandoned and that the recovery of that base would become the main objective of those fleets, thus illustrating the inter-dependence of fleets and seacoast fortifications. If the base under fortifications were able to hold out for a time against hostile attacks until the fleet arrived, the naval action at that point would become of vast importance and one in which the advantage would be with us, whereas with the enemy in possession the reverse would be equally true. Consider further the condition of vessels as to coal efficiency after steaming at speed from our northern ports to the southern waters, if deprived of the ability to replenish the depleted bunkers at friendly bases while the hostile fleet is in the vicinity. In a strategic sense the Florida

Keys are nearer to more strongholds of foreign power and influence in this hemisphere than are any other points upon the mainland, and, thrust far out to the southeast or west, a vast stream of commerce flows unceasingly by them. The situation in both the military and commercial sense but repeats that at Gibraltar, Taranto and The Skaw. The Tortugas in addition look well towards the channel of Yucatan, and it is good that such an important place has been accorded them in the general scheme of fortification. The gulf coast continues the general strategic features of the southern Atlantic coast, at several points permitting the entrance of large vessels, but at other points the defenses should be of the strongest, and able to withstand the attack to which their location and the depth of water may lay them open, while points completely exposed to attack should be neglected.

In general, the character of the gulf coast is not different from that of the section just considered, there not being many breaks in its continuity admitting large vessels, and the feature of outlying bars being equally characteristic of the two sections, it may be safely assumed that the system of coast fortifications applicable to one section of the coast would apply equally to the other.

The Delta of the Mississippi is flanked by sounds and lakes connecting with the stream itself by canals. None of these waters is of suitable depth for occupancy by foreign squadrons, for they are navigable by light-draft vessels only. The modern conditions are such that an attempt at a coup-de-main with New Orleans for an objective could or should be easily repulsed. The former deficiencies in transportation and communication have been entirely removed, and the whole strength of the country could be readily thrown into the defense. It may be assumed that an enemy could readily blockade the passes and might even artificially obstruct the South Pass, assuming the absence of our naval force, but it does not seem likely that an enemy in face of modern defenses would care to repeat the action of Admiral Farragut. Torpedo-boats constituting a river flotilla could operate in the delta under the most favorable circumstances. No other means for preventing the obstruction of the passes is apparent if the command of the gulf is lost to us.

Without dwelling upon the strategic features of the Pacific

coast or of the shores of the Great Lakes, the author cannot dwell too earnestly upon the fact so often insisted upon in these pages, that, in any system of fortifications projected or in course of construction, the question of fortifying this or that point to a greater or lesser extent resolves itself into the strength of the naval attack to which it may be subjected. In other words, it is not purely a question of the strength of attack which can be delivered without reference to what our fleets may be doing in other parts of the world to prevent such an attack, but that it is a question, first, last, and all the time, what are those fleets doing to that end, for without those fleets, the fortifications are useless; hence the pre-eminence which should be accorded to the naval strategy of a nation when any scheme is under consideration involving the defense of coasts. Fortifications do not set fleets free, nor do great fleets remove the need for fortifications, for at certain well-chosen spots there must be fortifications under cover of which those fleets may replenish and refit; and which, in the absence of those fleets, may yet withstand an attack for a time sufficient to permit their relief from the sea. It is unnecessary to recall the use to Cervera of the fortifications of Santiago, but another example occuring during the same war does not appear to have been emphasized to the same extent. The squadron posted in Hampton Roads during the opening days of the war under certain supposable circumstances might have derived the same benefit from fortifications. If threatened by the attack of a superior fleet, which had arrived on the coast in fighting condition, the squadron had been compelled, through need of refitting, to seek a harbor or have been caught at anchor in the harbor, the fortification would have played an important part. When ready, the squadron, inferior or superior, could have met the enemy, with the result that, if not victorious, the enemy's squadron would have been in no condition to have undertaken territorial attacks. Further, it may be asserted that a hostile squadron appearing off our coast with the knowledge that our squadron, though inferior, was intact, and at a well chosen point, would not venture to undertake any operations against any part of our coastline requiring time for its execution.

From Hampton Roads our squadron can relieve any part of the threatened Atlantic seaboard, and with a squadron at Key

West, the entire Atlantic coast is covered. Fortifications cause the necessary pause or delay, for, in attacking them, the ammunition is exhausted even though the attack has not suffered material injury, and in this condition the fleet is in the worst possible condition to support a contest at sea. This use of a defending fleet is what is expressed in the term flanking fleet, and is, without doubt, the use for which the squadron at Hampton Roads was intended, for Cervera would have had but scant opportunity for territorial attacks before the squadron would have challenged him upon the scene, and Cervera being a naval strategist, would not have undertaken such enterprises until our squadron had been disposed of. As a naval strategist, his only possible objective at that time could have been our floating forces, and hence it should be apparent how these squadrons were protecting the great military and commercial ports of the nation though seemingly idle in port. When, later, the Spanish Navy had ceased to be a military factor to be seriously considered, it was open to us, having command of the sea, to undertake any form of territorial conquest which might have been deemed desirable.

The purely naval attack upon a fortress, or the dispositions for the defense of a maritime fortress, subjected to a naval attack scarcely can be classed with any other operation of war, although various comparisons have been instituted, but not generally sufficiently sustained by argument or example, the closest comparison perhaps being to that of a siege in regular order maintained against a land fortress, and in this case the analogy fails in many essentials. It is usually accepted that if siege be adequately laid to any fortress which cannot be relieved, the fortress must fall, the conditions being that the besieger must be able, while constantly assuming the offensive, to deprive the besieged of his communications. Under these circumstances the besieger is constantly gaining in strength, or at least replacing his losses, while the strength of the besieged is being gradually sapped and undermined without power of renewal.

In order to fulfil these conditions in the siege of a maritime stronghold, there is necessary to the fleet an adequate landing force, which, while laying siege to the position, effectually

shutting it in from outside aid, derives its support and sustenance from the fleet, the analogy here being more or less complete. The artillery of the fleet performs the part of the artillery of the siege in keeping down the fire of the besieged, thus restricting the action of the fleet to that of the siege artillery.

The naval history of the Civil War is rich in examples illustrative of this duty of vessels, frequently the fire of the fleet in combination with the siege artillery of the military forces preparing the way for the assault.

No further comparison of the action of ships with that of artillery in the field can be drawn from the simple consideration of the fact that the target of field artillery is only in part the opposing artillery, while the target of ships in action against fortifications (proper fortifications) should be almost entirely the opposing guns, for, as before stated, it is true that every shot that imbeds itself in properly constructed earthworks, that falls short or over the crest, or that fails to injure a gun or carriage, is lost except for the moral effect produced.

In endeavoring to arrive at some deductions that may be applicable to the class of operations under consideration, it is natural and proper to seek for analogies, which may tend to elucidate the principles which should guide the attack or the defense in such operations. When the attacking squadron has arrived before a port with the intention of operating offensively, strategy has given way to tactics, and it may be that in the present universal state of uncertainty concerning the tactical application of the highly developed modern weapons, that changes of importance are required in our conceptions as to that application. Military students have arrived at a gratifying concensus of opinion that the principles of military and naval strategy are identical as well as immutable. There is, however, no such consensus of opinion when the subject of tactics is under consideration, and for this reason, the assertion is ventured here, with hesitation, that the differences may be more relative and less radical than generally supposed, and that tactical principles have not changed to the extent sometimes insisted upon, and certainly not to the extent that weapons have changed or improved. Angles of presentment will be different, ranges will be widely different, and the targets offered

by ships as well as fortifications have undergone radical changes, but before a fight takes place the ships as formerly have got to be brought to their fighting ranges, and when there they must be maneuvered—the motive power of steam permitting these operations to be made with far greater certainty and precision than formerly, but it cannot be positively stated that the tactics in the attack and defense have been radically changed thereby. The sailing fleet had to wait for its opportunity, but when the opportunity arrived, it had to be handled with the same tactical ends in view. The greater tactical differences will perhaps be found in the guns and targets, but formerly the target for guns on shore was the motive power represented by the sails and rigging, with the crews at the guns. To-day the crew and guns, the flotability, and the motive power are still the targets, though the conditions under which they are to be attacked are totally different.

In the case of a fleet unaided beginning operations against a maritime position, it will be found that its front of operations will in most cases be restricted if the defense has done its duty. The character of the weapons will determine the varying distances covered by fire, but it will be apparent that a fortified port, as an army in line of battle, will have but the three zones of operations, the right, the centre, and the left. The geographical features of the line of defense will generally determine the weakest point of the three and the relative strength and importance of each; the ordinary form of many harbors offering an angle, or a curve, re-entrant as regards the shore, will hardly furnish a doubt but that the centre is the strongest, and the great majority of the fortifications will command the area in its front, which is but the case of the front of an army in such a line.

An attack in strength upon an extremity of the line of defense, enveloping it in a concentrated fire, might neutralize the advantages of the defense in some degree, depriving it of its cross fire, and securing for the attack what advantages could be obtained from the use of enfilading fire; at any rate, the fleet concentrates its strength upon the part of the line which the defense is less likely to be able to support; as at Charleston we see the ironclad fleet finally learning that lesson, whatever might have been the case as regards the ability of the fleet to

have gone on to the city at any time, when it settled down to the silencing or reduction of Wagner it was doing the right thing, tactically considered, and when Dupont subdued the forts at Port Royal he concentrated his fire first upon one, then upon the other.

When the line of defense presents the rare case of a salient to the sea, it may be judicious for the fleet to disperse over only a portion of the defense perhaps, thus masking the remainder while maintaining a cross fire over the works, obtaining what advantages there may be from reverse fire; of course flanks cannot be driven in, nor the centre broken in the sense that the flanks of an army may be driven in and thrown into confusion, but the same results may be produced.

Having dwelt to some extent upon the tactical limits of weapons and accessories, and their use afloat and ashore, it may not be amiss to examine somewhat closely the problem confronting an admiral under instructions to make an attack in force upon a fortified port of the first rank, bearing in mind that, while the whole system of coast defense to whatever extent it is carried is based solely upon the probable nature and extent of an attack, and that attack must be modified and controlled by the state of preparation of the defense. The position of the defense will be nearly as follows: the guns mounted will perhaps be equal in numbers and power to those of the attack, and the direction of that attack being closely a matter of dividers in the hands of the defense, the guns will be so placed, governed by the character of the land, as to maintain a continuous fire over the entire water approaches from the extremest effective range to the line marking the draft of water beyond which the ships may not advance. A skilful arrangement of the batteries will enable this concentrated fire to be maintained with the greatest number of guns, and it will be noticed that the initial fire of the defense will be that from the heaviest guns and from the mortars; and as the arc of fire narrows, the volume will increase as the range of the lighter quicker fire guns becomes effective. In some harbors a concentration of fire will be possible over the entire front of operations of the attack, while in others, there will be centres of concentration owing to the irregular configuration of the coastline in which centres various groups of batteries will offer mutual support.

All the possible combinations of fire will be studied and prepared beforehand it is to be hoped over the whole known ground; the standard of perfection being the greatest possible volume and intensity of fire over the zone of approach. So far as compatible with this standard, the guns themselves will be as widely dispersed laterally and in elevation as possible,—every feature of the terrain tending to invisibility will be utilized. Engineers charged with the construction of seacoast defenses should make a part of their study from the sea, so that they may know that the works are concealed. Mortars will remain entirely concealed, and at a distance of 2000 yards it should be next to impossible with a powerful glass even to see a gun properly mounted under the ordinary atmospheric conditions that obtain in seaports. The supply of ammunition of the defense may be assumed to be practically inexhaustible; and it scarcely can be expected that the bitter lessons of the past in the matter of the danger following its exposure will be ignored. Attempts have been made to assign a primary position to the submarine system of defense of a fortified port, but, important as it is, it must rank second to the gun defense, from the simple consideration of the fact that unless mines are covered and flanked by guns they can readily and easily be removed, as was repeatedly done during the Civil War, and is to-day accomplished in the annual maneuvers. A question that suggests itself at once regarding obstructions of all kinds and concerning their rôle of defense is, is it desirable to forbid the attacking fleet approaching to fighting ranges, or, is the defense strong enough to desire a trial of strength? While it may not be contemplated that a fleet will entangle itself in a mesh of obstructions, it is possible that the attempts at countermining may have had only partial success, or the damage done may have been repaired; or once in the mine field, the injury or alarm of one ship, the moral effect especially in a narrow channel, may give the defense the opportunity it desires. This would indicate that the mine field should cover the locus of the effective fire of the defense, but if delay is vital to the defense, the mine system should be more advanced and extended. Should the harbor possess several channels of approach, all but one would probably have been strewn with contact mines of the most effective type, which are at the same time the most dangerous. One channel preserved

for friendly use to the last may have been provided with the electrical contact mines, acting upon contact or not, at the will of the observer, though in presence of a hostile fleet the more effective mine may have been substituted; all this upon a prearranged plan. The channels will be further obstructed; delay to the fleet, at any rate under fire, is vital to the defense. All questions of exit or entrance other than to those of the mobile defense or to friendly vessels should now be waived. For the proper operations of mine fields, a system of position finding is essential, and would be thoroughly worked out, and at the present stage of range and position finding for the proper service of guns on shore, it may be assumed that the gunners will be furnished momentarily with all the data needful for the accurate pointing and ranging of their guns, if indeed the guns are not pointed by the mechanism of the finder itself.

The searchlights will be so placed and so handled as to illuminate at the proper time and in the proper way points needful to enable the gunners to lay their guns without the embarassment that attends the improper use of those valuable auxiliaries, and they should be arranged in positions separate from the batteries and independent altogether of them, while others should cover the mine field, positions near the water being the best. The source of the beam will naturally be a target for machine gun fire or quick fire, and there is no reason why the batteries should be subject to that fire with them; besides, when near the guns, the aim is deranged through many causes—reflections on the sights, brilliancy of the beam and others—and further, positions away from the light are better for observers as well as for the gunners. Experiment has amply proven that positions for the lights are better located away from the guns, the reason being the interference in the beam of light of particles of dust, and the presence of smoke or mist, with the consequent repeated reflections caused by such particles. An observer near the source of light has all these reflections against him, while if the observer is above the level of the lights, the area illuminated is more under his observation. The chances of the light being hit are extremely small, for in the face of the brilliant illumination, neighboring objects are relatively more indistinct, and an accurate estimation of distances is out of the question. At point-blank ranges

only is a successful hit on a searchlight more than a mere chance, and if in addition the light can be shifted occasionally, or, as has been suggested, if the light be shielded entirely, throwing its rays upon a comparatively cheap reflecting surface, the problem of protection to the lights is solved.

Experiments carried out in England between the years 1884 and 1888 go to show most conclusively that the searchlight is most valuable to the defense, especially when its beam is thrown over a water surface. It was found impossible either to get the range of a searchlight or to give aim properly when the sights were in the sector of the beam; this was the case both when small arms and machine guns were used. From the nature of things, the flanking defenses may be well advanced in front of the main defense, and provision made against a party landed to destroy them which will be best effected by rifle and machine gun fire over any ground practicable for the landing or approach of such parties. If the countermining flotilla has within its numbers a vessel or vessels provided with searchlights, a good tactical use of the light in that case would be to throw its rays directly into the eyes of the gunners on shore; the vessel using the light in such a way would be a comparatively poor target, and would thus furnish a valuable diversion favoring the object of attack.

The vedette duties for a seaport can be performed perfectly by torpedo-boats unless steam tugs and yachts are deemed available for that purpose; there seems no need for an especial type for the performance of this duty, the importance of which is perhaps on the increase. The torpedoes, other than mines, controllable or automobile, operated from shore stations will be in a state of readiness for use at the proper time; and so far as organization and system can go there should be no misdirection in their use. Lastly, to complete this resumé of the condition of a fortified port, it is fair to assume that there is free and easy communication between all its parts and a perfect community of interest, each element developing its efficiency to the utmost, while a harmony is maintained throughout the whole, the key to all being organization.

Before bringing the forces to the test of battle, it is well to understand the status of the attacking fleet as it may be constituted. On the original assumption upon which the system

of fortification has been based, the attack will bring to bear in armor-clad vessels, an armament not inferior to that on shore, equally protected over limited areas, and a large secondary armament. The attack will also include a number of cruisers of small protection but of large secondary battery and strength, besides a numerous flotilla of the most efficient seagoing torpedo vessels, as well as boats of a smaller type transported in depot or other ships. There will also be repair ships, ammunition transports, supply ships of all kinds; and very likely there will accompany the fleet, vessels of an especial type prepared for the particular operation in view. The batteries of the fleets will possibly number amongst their weapons guns for curved and high angle fire, and for the use of high explosives, unless, indeed, high explosives and smokeless powder do not form the greater part of the ammunition of the fleet. Just as the siege of a great land fortress is not carried on by an army constituted for field operations, but is a matter requiring especial preparation and appurtenances, so will the naval siege of a maritime fortress only be attempted with especial appliances, and such a fleet will not be brought complete into the presence of coast defense. A secure station will have been established, and only the effective fighting part of the fleet will proceed at first to the active work of the siege.

Such being the constitution of the defense and the attack, the relative limitations and advantages of each should now be considered, and in this connection analysis may prove the safest guide. The defense, as should be the case in all military operations, has been prepared deliberately in advance to the best advantage upon the field of battle, the direction of the attack having been restricted and having been foreseen. To offset this advantage, the defense has no mobility, no power other than in the possession of especial vessels to assume the offensive at appropriate times. It is not necessary to compare the relative gun efficiency of the attack and defense, as to which has the advantage, the fixed gun firing at a moving target, or the moving gun whose target is fixed—the range and position finder and smokeless powder have settled that question in favor of the defense. It may be urged against this opinion that the range and position finder has found its application on board ship, but thus far its base line is limited; its efficiency is

impaired on certain bearings, and the slightest unsteadiness of the ship will preclude the laying of guns otherwise than by direct sight; it is further considered unreliable on board ship from the rupturing of its connections by shock. On shore the choice of base lines is almost unfettered; the steady guns may be laid in various ways, and, in the case of mortars, nothing whatever is gained by a direct visual pointing. The range and position finders on board ship cannot avoid the shock, while those on shore can be placed so as to be but slightly, if at all, embarrassed by it. It has been said that a tendency existed to underrate the advantage possessed by the ship in its mobility, but if it is considered that both the fire from the ship and from the shore are affected in the same degree by that mobility, and that every hit on the ship tells, while only hits on the gun or its carriage or in the magazines (which, as before stated, should be impossible) are fatal to properly installed shore guns, it may perhaps be admitted that fixed guns have the advantage.

The defense should be enabled, so far as the ammunition is concerned, to sustain an unlimited siege, and, while the attacking fleet can keep up its supplies by sea, the advantage in this respect would seem to rest with the defense. Should the attack be undertaken while the defense had at some other point a floating force yet intact and unmasked, the attack would be liable to the loss of its supply vessels en route, another illustration of the influence of a fleet in protecting a coast, for under such circumstances the attack could not be delivered. At close range the defense may possess a certain mobility if comparatively heavy guns can be transported from point to point, thereby enabling an unexpected concentration of fire upon the unarmored portions of vessels.*

No other advantages possessed by the defense seem specially noteworthy, unless reference is made to the delaying power in its hands in the shape of obstructions perhaps renewed from time to time. The attack has the choice of the time and manner in which to give the assault, and also is not ignorant of the

* It is stated that the Confederates, at least in the Ogeechee River works, shifted the position of their guns with good results when attacked at different times by monitors.

field of battle, having exhausted every means of obtaining i
mation, through its intelligence staff, through capture,
through reconnaissances. It can deliver the assault as it ple
while its guns can support or concentrate their fire in all
sible combinations, limited only by the water approach
the attack fails or seems hopeless, it can withdraw; whil
the other hand, if it succeeds and the defense is silence
destroyed, the attack by ships must call in another for
profit to the full from the victory. If the object be other
mere destruction, this is as well a limitation placed upo
defense, the only result it can hope to draw from success
the repulse of the attack with such incidental losses a
attack may suffer. The defense must fight when and ho
attack pleases, and can reap no further advantage from su
than the maintenance of its integrity, and must remain in
tion subject to further attack, an attack perhaps delivered
new lines.

Having thus considered the constitution of the attack
the defense, their limitations and relative advantages and
advantages, it will next be proper to examine the object
attack may have in view, as influencing the mode or mann
attack. In this examination the defense has little standing
it has perforce covered all contingencies as far as lay w
its power, but it cannot be assumed that the attack intelli
delivered will proceed as though there were no object
than a test of strength. The defense, we will say, will c
an arsenal, a naval arsenal; and, as is usually the case,
location of an arsenal is a pivotal point of commerce a
decisive strategic point of the littoral, and also a great
It may be that an inferior fleet and improvised coast-def
vessels are sheltered within the works, a not unusual cond
in the light of experience. The political character of the
will be a large factor in determining the objective, as will
the opinion the attack holds of the defense affect the ma
of attacking that objective.

The objective may be the destruction of the arsenal
shipping, as was the case at several places during the Civil
If this cannot be attained by distant bombardment, the fort
tions must be silenced and passed; the same being true i
objective is to obtain a money ransom from the city, u

threat of bombardment, and a great deal is heard of this objective nowadays.

It may well be stated that the fears of our own people on this point are excessive. To reach the outskirts of Brooklyn—the only points than can be reached by shell fire from the sea—vessels drawing 20 feet of water and over can approach in safety only to within about six miles, and only then by placing themselves in a narrow, dangerous pocket. If under fire from concealed gun and mortar batteries, their practice with the extreme elevation demanded should not be very satisfactory, and certainly need not cause panic among the population. There is also, as we have seen, a trend of thought, more or less expert, toward a naval warfare of destruction both of public and of private property. If there be truth in the views before quoted, views which receive a certain amount of support, such a warfare may be looked for. If the vessels of the inferior naval force—and it is acknowledged there are grounds for the belief in recent wars—are going to shut themselves up under the guns of fortified ports, there will be little for the superior navy to do after dispositions have been made for a war on commerce, if he is not to attack the enemy in his ports in case he cannot draw him out. The shutting up of the enemy will hardly be sufficient to the attacking fleet or to the people behind it, apart from the fact that the lapse of time under certain conditions tells more against the attack than the defense.

It may be assumed that few considerations will deter hostile vessels from demanding an indemnity from towns and cities liable to bombardment, and this cannot be prevented, and the reduction of such places may be exceptionally a military necessity, perhaps to break up a focus of opposition. Bombardments of the strong points of very inferior powers are produc-

*It is stated that in the instructions issued to Commandants of English Fortresses some years back directing them to prepare complete schemes for the defense of the places under their jurisdiction, that the effect of bombardment was in nearly every case more moral than actual upon the public, and that if good arrangements were made for putting out fires, arrangements which have been organized in these stations as far as possible in times of peace, no place need submit to pay forced contributions simply because it is threatened with bombardment at long range.

tive at times of important results even where the power of retaliation is absent.*

Concerning the point whether vessels should anchor or not in engaging fortifications, Captain Goodrich says in reference to the Alexandria bombardment: "Hammering away was very skilfull, and, in the end, was tolerably fortunate, but it is certain that the length of the action, while abundantly foreshadowed in Admiral Seymour's order of the battle, was a disappointment to those who expected short work to be made of the Egyptians, while it drained the stock of ammunition to a dangerously low ebb. The outside squadron having tried both modes of attack, under way and at anchor, definitely solved one important problem: There remains no possible doubt that ships engaging forts not superior to them in force gain more in accuracy of fire by anchoring than in safety by keeping under way."

If the action is carried on with the ships under way, they may fire from fixed points, and they need be under way only in case the high angle fire from shore is accurate enough to make their danger from that source very real; and torpedo flotillas may compel the attacking fleet to remain under way, and no doubt will do so, if the past be any guide. The defense will hardly make use of torpedo-boats by daylight as an offensive return to such an attack, although attempts may be made, but at night they will assuredly endeavor to find and attack the squadron. The answer of the attack would be the vigilant picket system, rapid-fire and machine guns, and a counter offensive with torpedo-boats, while its mobility would be the best defense.

It may form part of the programme of the attack to occupy the position assaulted as the base; the destruction of the material interests of the place then would not be politic. At Port Royal it was necessary to overcome the fortifications at the entrance, the object was the undisturbed occupation of the Roads as a base. It may be necessary to break up the commerce of the place, and if the blockade is not sufficient, the overcoming of its defenses and its occupation will be incumbent

* It is said that in 1878 the Russian Admirals in the East had instructions to demand large sums of money from Sydney and Melbourne under threat of bombardment with some hours notice.

upon the attack. While the blockade at Charleston and the Cape Fear River became remarkably effective, it was deemed advisable to make prodigious efforts for the reduction and possession of their defenses. The objective of the action in the Mississippi was New Orleans, and the severing of the Confederacy a part of the anaconda policy practiced towards the South. All the fortifications on the river did not materially aid the Confederacy in maintaining its communications, the forts were only passed, falling by their own weight when the fleet had run by them, thus severing their communications and opening the river. At Mobile the defending fleet having been beaten and the fortifications overcome, the blockade was absolute; the city and shipping did not suffer. These examples only emphasize the fact that between a fleet and fortifications, there will not be a blind struggle, but a carefully planned and executed exhibition of tactical skill, having constantly in view on the side of the attack a well-defined objective, to the frustration of which all the energies of the defense will be bent.

The objectives, then, which an attacking fleet might have in view may be as follows:

1. Complete conquest and occupation, which, however, may be only temporary.

2. The destruction of the defenses and war material, or of either.

3. Bombardment of cities before or after the defenses have been silenced, perhaps following a demand for ransom.

4. The destruction of shipping.

5. The results to be obtained from raids.

A reconnaissance will precede all attacks of magnitude of whatever nation; it will be made by fast cruisers or torpedo cruisers, and should have for its object the locating so far as possible, and estimating the nature and strength of all the defensive resources. This service will require a large amount of skill, demanding for its performance a fine military insight. Soundings should, in cases, be taken and sketches made, all changes in the aids to navigation noted; and it would be one of the many duties of this party to make captures of boats or fishermen, landing if necessary for the purpose. These rapid cruisers fulfil the purpose of cavalry in this respect. A reconnaissance further should also have for its objects the selecting

of landmarks or constructions that might serve in ranging the guns, or as marking the positions to be reached by gun fire. The examination should also have for one of its objects the searching out of the nests of torpedo boats along the coast, and should be made in force and numbers sufficient to break them up and destroy or capture boats wherever found. Other objects to be obtained will suggest themselves, such as laying buoys for ranges, and if deemed necessary, drawing the fire of the batteries. The reply of the defense lies in the perfection of its signalling system, picket boats, and the facility and safety with which the torpedo-boats can be moved from point to point, ready to avail of opportunities to attack.

One precaution to be observed by the defense is so obvious in time of war that it hardly needs notice, that is, to remove from the coast or from the vicinity liable to attack by cruisers or raiders, anything that can in any way benefit them—live stock, rolling stock, stores of all kinds—and all pilots and persons competent for pilot work should be placed under surveillance. The reconnoitering vessels besides their duties as outlined pertaining to the reconnaissances of selected ports, would have the still more vital duties of searching out the defense fleets. The smaller, the more numerous and more rapid the vessels, the more effectively could they perform all their multifarious duties. Matters of importance will require to be communicated at once to the fleet, and yet touch should not be lost with the enemy. The mine fields will first demand attention by the attack, if they are so placed as to interfere with the fleet in properly posting itself to begin the attack. Being perfectly under the command of rapid-fire and machine guns, riflemen, and even old-type guns using shrapnel and canister, as well as many of the guns of the main defenses, no efforts will be made at countermining by daylight other than such as may be made by projecting explosives into the mine field and by a fire maintained on the guns of the flanking defense. Night furnishes the opportunity for countermining. The defense will be with searchlights, torpedo-boats, and vedettes or picket boats, and the flanking guns; the vedettes and torpedo-boats to give the alarm and to engage if able. The searchlights should cover a well-defined line in advance of the obstructions, or both in advance and in rear. It does not seem proper

that they should be continually in use. They would but mark the position of the mines for a wary enemy able to draw deductions. They may come into use upon the alarm from the vedettes, or they may be automatically put in action by the attacking or countermining parties.

It has also been proposed that a discharge from the flanking guns over the line might be effected in the same manner; this would seem to be an unnecessary complication apart from the consideration of the width to be covered by such a discharge. Boat torpedoes in advance of the fixed obstructions, or fixed to them, are efficient weapons for the defense.

In the laying of countermines and the throwing of explosives into the mine field, advantage will be taken of the shadows on the water under the land for the concealment of operations. A point vital to both the attack and defense is a simple and effective system for the recognition of friendly vessels, large and small, which will not betray their position to the enemy. Under a proper system combining mines, rapid-fire guns, search-lights, and mobile defenses, countermining promises to be a very desperate business, and such a system will render cutting out expeditions next to impossible, while the attack may be driven to attempts by land against the flanking defenses of the mines, the guns, lights and firing stations.

Should the mine system be restricted to a point or position where the defense is able to concentrate an overwhelming fire upon the attack, it may be that the attack can proceed to take position for overcoming the less supported works and the flanking defenses, intending to operate later against the mine field, or both operations may proceed simultaneously; or the fleet attack by day, the countermining by night. This latter was the position at Charleston, but serious countermining seems to have been omitted. It has been suggested that, in addition to replacing mines destroyed as rapidly as may be possible, the defense should undertake to mine by night the position occupied by the fleet by day. That position, however, will be patrolled by the torpedo craft and vedettes of the attack, and such an attempt would partake of the nature of a folorn hope.

The torpedo flotilla of the defense set apart for offensive action against the fleet would search out the vessels during the

night; there should be no rest for the attacking fleet, no anchoring. The operation of coaling or receiving other supplies from transports would furnish an opportunity that should not be lost. For its own protection against the torpedo-boats the attack has nets, which so far seem liable to be a source of danger and embarrassment rather than of protection; but better still, its own vedettes, and its mobility which enables it to conceal its whereabouts. While it is possible that opportunities may arise during the main action for the torpedo-boats under cover of smoke to attack the vessels, it seems a desperate service. No chance should be neglected to disturb the attack in its base, the neighborhood of a few torpedo-boats belonging to the defense would be source of serious concern to the attack, compelling the attack to take every possible precaution with the result of greatly exhausting and hampering him in all his preparatory operations. The very best protection the attack can have against torpedo-boats is to guard by torpedo vessels and vedettes the outlets used by the boats of the defense, and to fight them in kind, reserving some for service near the rendezvous of the fleet itself—a simple application of a broad strategic principle.

In an open harbor in crescent form, the batteries being at intervals along the shore, a fleet if possessing an overwhelming gun strength might operate along the entire line, vessels in accordance with their power being told off for the purpose of occupying the attention of the individual works. The fleet, not in such force, would do better if the destruction of the batteries was desired, by concentrating its fire upon the shore batteries in succession. Some vessels might be employed in occupying batteries that might furnish a cross fire. There is apparently a tendency in artillery contests to respond to the fire directed upon one or the other party, and a few ships drawing the fire of such batteries dangerously placed would render good assistance. It seems, however, that the best attack to be made upon a line of batteries in crescent form would be upon the flanking batteries at one end; others would be raked, and the batteries at the other end probably would not be able to use their guns effectively.

As the tactics best suited to individual vessels in action with coast defenses should be determined by the balancing of their

qualities, such ships as have their principal or main battery assembled in turrets at either end or at both ends covered with heavy armor, and are comparatively deficient in broadside armor, would undoubtedly be in their most favorable position for defense or immunity from damage from horizontal fire when end on. That position, however, is the worst as regards vertical fire, and such a vessel can bring the greatest number of guns to bear by assuming a bow and quarter position to the object of her attack, that is, all of her main battery and half her secondary battery, while exposing her sides only to oblique hits. But it is extremely unlikely that in making the attack either from anchor or under way that heavy vessels will be able continuously either to choose or hold their most favorable positions. The current and wind may at times favor them, but if in motion in contracted waters they are sure to be thrown out; the effort, however, will be made.

If the main attack is not to be made at extreme ranges, there will be a period of time when the vessels are assuming their position that their fire will be restricted owing to the maneuvering to get into position, during which time they will be under fire of the defense; this opportunity will not be neglected by the defense. In the accounts of sieges in other days, in many cases, as before noted, the attacking vessels were allowed to take their positions, moor, and bring their broadsides to bear, unmolested.

The problem of the attack and defense of a perfectly open harbor is not very interesting, especially, as is generally the case, if the defenses lie close to the interests to be covered. Such a harbor would be undesirable as a base for naval operations owing to the difficulty in securing the anchorage. The interest could be destroyed without engaging the batteries, and if they should be engaged, it would require to be at such close ranges in order to be effective that the fleet would be in a very dangerous position. Such a place, moreover, would be somewhat vulnerable to a coup-de-main. Its sea defense, while very defective, would perhaps be deterrent from all considerations.

Harbors are of all kinds and descriptions, but so far as the tactics involved in their attack is concerned, they divide themselves into but few groups: perfectly open harbors; the kind where the harbor forms a longer or shorter pocket in the shore

line susceptible of defense throughout its extent; and the kind with an entrance susceptible of defense, which defense once passed, an open harbor with a stretch of water lies beyond. There are many variations, but these three types cover the majority of cases. The objectives behind the defense vary, but to get at them in these last two cases, whatever they may be, the line of defense must be passed or thrown down. Nature or art may render the attack easier or more difficult, as the case may be, but it is a difference in degree only. The last case covers that of a deep river, or the entrance to a large bay or an estuary. The second case covers such harbors as Sebastopol, Port Royal or Portland for example; Key West in reality, though it would seem to be a case apart. In the first case, that of open harbors, submarine mines and other obstructions are inapplicable generally, because of the width of the front of operations and the depth of water.

The Civil War established an axiom for all the world, that without obstructions fixed defenses could be passed. Calculations to-day go to show that, notwithstanding the improved accuracy and rapidity of fire, vessels may still slip by defenses unprovided with obstructions, but if the batteries are judiciously placed relative to the channel the risks may be made very great. It may be said with safety that proper obstructions will not permit their being charged at speed, nor will the expedient of sending ahead useless ships prevail where the mines can be exploded at will. If it becomes necessary to force an entrance, the mines must be exploded or removed, and then the case is simply one of running by before they are replaced. If the defenses can be attacked without or beyond danger from the mines, the only tactical matter to be regarded is to so attack the defenses if possible as to neutralize a portion of their fire. If the defense can be overcome in that manner or effectually silenced, the removal of the obstructions becomes a matter of routine; the mines and the guns in this sense appearing as coördinate and supplementary features.

The case of the narrow deep harbor, perhaps characterized by an intricate channel, with its interests at a safe distance from the entrance, its entrance obstructed and the gun defenses supporting each other throughout, offers an ideal of harbor defenses. The attack upon such a position by vessels is justly

regarded as desperate, if not hopeless, and there is little likelihood that it will be attempted in the present stage of naval development. Kiel is such a harbor, as also is Brest, or Santiago de Cuba. If it must be attempted, the attacking squadron must sit down to the task of countermining, but such a place offers the readiest opportunities for keeping the mines in place. The defenses at the entrance must be constantly assailed, for their reduction will facilitate the countermining. If both are successful, the entrance has still to be forced under a concentrated and converging fire growing constantly more intense. No tactical combinations are possible, the vessels must enter in column. The leading vessels must bear the brunt of the effort—the rôle of the leader in column always—interior mines and controlled torpedoes may still require to be dealt with, and torpedo-boats at this stage surely. No, a squadron will not make such an attack; but if it does, there is no other way. If the defenses are concentrated about the entrance, the attack is simpler, but must be proceeded with in the same manner. The ammunition will run out, coal become exhausted, repairs will be required, and vessels will be passing to and from the base, and such opportunities will not be neglected by the defense.

A harbor with the entrance opening into a bay, and with the defenses grouped at the entrance—the entrance being narrow and commanded from both sides—may require to be forced in the same manner as above described. Otherwise it may be possible to concentrate all the powers of attack first upon the defenses of one side by passing in, after the removal of the obstructions, close to that side, or by concentration upon the defenses of one side from the outside. It is always well to have in mind that the defenses cannot be perfect, and from the nature of the ground the engineer may have been obliged to leave a weak point, which should always be looked for when the defenses seem the most perfect. With regard to the nature of the ammunition to be used, armor-piercing shell would seem to be thrown away against works other than turrets or iron-faced works; the guns, detachments and magazines being the targets, common shell and shrapnel appear to be the projectiles promising the best results. Common shell, shrapnel, and perhaps canister or case shot, though its efficiency is doubtful, will be used from the rapid-fire armament; the guns, embrasures

and pits should be sought out, and if the magazines are known, they should receive attention. Observation stations of whatever character should be looked for and attacked. Ships should not be diverted from the objects of their attack, unless a counter-attack requires serious attention.

The subject of the attack, perhaps more especially than the defense of a strongly fortified maritime position, is one that has not been very seriously approached, and it is almost a certainty that the development in war material has still further strengthened the hands of the defense. The very fact that modern progress has compelled the thrusting of coast defenses well to the front is an advantage to the defense in removing the actual struggle further from the interests covered. In the navy, a great deal of the progress is perhaps groping in the dark, while many of the elements which go to make a successful defense are subject to somewhat rigid treatment. Notwithstanding the fact that navies exhibit a marked tendency towards a higher development, vessels constantly appear which in their conception may be called ultra modern; while coast defenses rarely, even beginning with an initial stage of high development, appear to keep up with the times. It is thus possible that, with the exception of large selected harbors, the distribution of advantages may leave the attack in the lead in actual, if not in theoretical, warfare.

It remains only to speak of raids; the forms which they may take are so different and the objects sought so various that there is little definite to be said about them. The principal danger to raiders will lie from the sea. Their object must be obtained through evasion; skill, nerve and watchfulness in the future will be the qualities required, as in the past. Fortifications, except of the lightest character, will not be encountered; the objects will be the acquiring of information, the destruction of the enemy's war material, or the securing of supplies for one's self; coast railroads should suffer, land and ocean telegraps as well; signal stations should be an especial object. The execution of a raid presupposes an insufficient force on the part of the raiders to encounter any but the slightest opposition, and it should be carried into execution with the greatest secrecy and suddenness, upon unsuspecting points. Raids may embarrass the mobilization of troops; they will certainly acquire

valuable information, and all the duties of reconnaissance will as well become their own.

War blockades may perhaps be referred to. Apart from masking and the shutting up an enemy, they may be maintained with the object of shutting an enemy out. In either case—without reference to masking, which is not blockade—the blockader is the superior and should desire a contact with the blockaded. Only the military blockade of military forces is referred to. It may be that the attempt will be made to blockade the whole coast, or only a part of it, or perhaps only one or two parts, but the tactics of the blockaded and the blockader will not be different in any case. In the first place it may be assumed that a complete steam blockade of steam vessels may not be absolutely maintained, either as regards ingress or egress. The condition of the vessels of the blockaded squadron themselves should be superior, and probably the morale of the officers and crews should be better, they not being worn out with watching and constant alertness; the strain upon them is great for a short time, while it is tremendous on the blockader always. Steam permits the blockaded, where there is more than one channel, to take either. In sailing days, probably but one entrance required guarding by the blockader, depending upon the prevailing direction of the wind.

The probable character of blockading fleets is a very good indication of what the proper tactics for them to follow should be. It is a safe assumption that blockading fleets constituted in the immediate future will consist of battleships, cruisers (scouts), gunboats, torpedo cruisers and vedettes; five types perhaps, but it would simplify matters to group them in three divisions, the third comprising cruisers less than 2000 tons, as, though the variation in types of less tonnage may be great, the duties they will be called upon to perform will not essentially be different, not so different as to warrant complicating the question by multiplying the number of general types. If we look first at the question from the point of view of the constitution of the blockading force, it will be apparent that the tactics will be or should be the same in both cases, the blockade inward or the blockade outward. The simple difference will be in the direction in which the front is presented, whether to seaward or to landward. As near as we know at present of

what will be the tactics of an expectant fleet in the open sea, there is essentially no difference between that and the tactics of a blockading fleet. In looking for or awaiting an enemy, the battleships are not thrown to the front. The scouts and vedetts would thus be deprived of any particular duties, and the line of battle would be subject to torpedo and ramming attacks without warning.

A blockade cannot be efficient unless it is maintained close into the port blockaded, whether the operation be masking or blockading. Light-draft, swift vessels fitted to cope with the efforts certain to be made to break the blockade by torpedo-boats and cruisers would seem to be the class upon which reliance must be placed for the inside work. With the scouts forming a second line and maintaining communication with the line of battle, it would appear that each part is fulfilling its duty to the utmost; the fighting line is relieved as far as possible from the designs of the mosquito attack, its strength is the better concealed, and the detachments to the base and the recruits from the base are somewhat unknown to the enemy. The port is hemmed in by a light mobile force and communications are kept up as rapidly as possible. For the blockaded fleet to escape undetected from such a guard can hardly be expected. A diversion must be created, a feint made, under cover of which the escape may be feasible. Mines in case of close blockade, amounting to shutting up the vessels, may play a prominent part. If the blockade front is seaward, the dispositions will naturally be somewhat different. The battleships should not be left unguarded to the rear or shorewards from torpedo attack. The scouts would then form the advanced line, the smaller craft performing their duties on the second line to seaward and to landward of the fleet. Front may sometimes have to be given both ways, in which case the number of scouts will have to be great, and the task will be difficult. It is not apprehended that the conditions governing a commercial blockade will be widely different.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

TORPEDO-BOAT ORGANIZATION AND SERVICE: ATLANTIC COAST OF THE UNITED STATES.*

By COMMANDER W. W. KIMBALL, U. S. Navy.

DESIDERATA.

1. To organize the service in such a way as to render possible the effective mobilization of the entire flotilla for war or practice in the shortest time.

2. To have at all times available a certain small number of trained torpedo-boat officers and men so organized as to furnish nuclei of crews for the whole flotilla, and thus guard against the necessity for manning boats with crews in which there would be no one with any torpedo-boat training.

3. To organize the trained men in such a way as to make the mobilization of the flotilla as inexpensive as possible.

4. To have the training in torpedo-boat service constantly going on and a consequent regular flow of torpedo-boat officers into general service.

5. To include in torpedo-boat training the investigation of our coast and practical studies of it as regards torpedo-boat operations.

GENERAL CONDITION OF THE PRESENT FLOTILLA IN CONNECTION WITH ITS DUTY IN THE MOBILE DEFENSES OF THE ATLANTIC COAST.

There are thirty boats built and building upon this coast, and among the thirty boats, seventeen different kinds are found, with differences ranging from that of a ratio of 6 to 1 in displacement to those of small differences in dimensions and

* Part of a lecture delivered at the Naval War College, July 25, 1901.

considerable differences in details of motive power, speed, endurance and maneuvering qualities.

Four is the greatest number of boats that can be considered sufficiently alike to apply to them the principle that men trained in one boat are competent to handle all other boats of that particular group, and therefore the method of training for groups which would be most satisfactory if our boats had been built in groups, can have only a partial application in the existing flotilla.

The boats mobilized for war must be available for use in the mobile defenses of the coast anywhere from Eastport to Galveston, concentrated in a particular locality or stationed in groups for the defense of several ports. It is now the practice of the Department to lay up boats not in commission at several naval stations, a few here and a few there, and for convenience as well as for possible strategic reasons this practice may continue; or the policy of laying boats up at some one general lay-up station may be adopted.

Since the only possible way to give nucleus crews the necessary familiarity with their boats is to familiarize them with their boats, any scheme for training crews must contemplate the moving about from station to station where the boats may be laid up, for the sake of practice with them and possibly for the sake of giving practice to the men who may make up the mobiliżation crews—real naval reserves or naval militia, or men from the fleet. In any case the actual running from time to time of all the boats that are to be mobilized for war must be provided for.

The running of all boats is necessary, not only for the efficient training of the nucleus crews, but for the insurance of in an efficient state of preservation, of the boats themselves.

Sufficient experience has been had with our torpedo-boats to accentuate the fact, well known abroad, that the hasty manning of laid-up boats with crews wholly green to torpedo-boat service and entirely unfamiliar with their particular boats makes strongly for great expense and pitiful inefficiency.

Suggested Method of gaining the Desiderata and meeting the Conditions mentioned.

Keep seven representative boats in commission at all times, working to the southward in the winter and northward in the

summer. Interchange boats in commission and boats laid up from time to time.

Organize in the crew of each commissioned boat four nucleus crews, and detail each nucleus for a particular boat.

Wherever a boat is found by the cruising division, anywhere from Kittery to Pensacola, put her nucleus crew on board, fill the crew with details of other nucleus crews to represent the green men of general mobilization, and run the boat till her nucleus crew knows how she should be handled to get the most efficiency out of her, and until each man in the nucleus crew knows how to instruct green men in the necessary details of his own duties.

Any nucleus crew of any particular boat would of course be available for duty as such in any of the own sisters of that particular boat, but for the reasons given before—the great number of large and small differences in types in the small flotilla of thirty boats—the nucleus crews must be assigned each to a boat, not a number of nuclei to a group, although it is apparent and a matter of experience that any lot of men who have been trained in any way in torpedo-boat service are vastly superior for any boat in that service to men drawn from general service on their record of work in ships.

When not at work in connection with the laid-up boats, the commissioned division would be available for real torpedo-boat work drill in a group, torpedo practice, of which there should be much, torpedo-boat investigation of the coast, and when practicable, for maneuvers against the fleet. The boats should cover the whole coast in cruising twice a year, *i. e.*, they should work south from the Maine coast so as to be to the southward of Hatteras by November 1, and north from the Texas coast so as to be northward of Hatteras by May 1.

Group drill could not be exact for the reason that, in order to provide for a proper mobilization of the whole flotilla, which is the chief object to work, for even if there were never such a mobilization till the outbreak of war, the boats of the commissioned division would necessarily be of several types.

Still the group drill would be most valuable in itself; and, moreover, it would furnish a means for cultivating that spirit of rivalry in doing good work which make so strongly for efficiency. For economy, training and efficiency, experience has proved:

(a) That the crews themselves, and not dockyard people, should make the small repairs constantly needed in boats in commission, should do the tuning up and adjustment of the machinery of all kinds, and should arrange the small fittings so necessary for serviceability.

(b) That the keeping of pay and expense accounts of a number of boats in commission at a shore station is complicated, onerous and very unsatisfactory.

(c) That the attaching of boats to "mother ships" which are men-of-war, is impracticable for the reasons that boats "mothered" are nuisances to the ships, that the ships often prove indifferent stepmothers rather than cherishing mothers, and that from the nature of the service they should do in the mobile defenses, the boats should be independent of the men-of-war as they would have to be in time of war.

(d) That the hiring of machine tools in ports where there are no naval stations, and the general use of machine tools of a naval station by the torpedo-boats' crews are both objectionable.

All these results of experience, as well as many requirements not here enumerated but exacted by the peculiarities of our torpedo-boat service upon our long stretch of coast, point directly to the supplying of such a torpedo-boat floating base as was recommended by the Board on Auxiliaries in the autumn of 1898.

TORPEDO-BOAT BASE VESSEL.

This should not be an expensive Vulcan, nor a collier pure and simple, nor a supply ship as such; but should possess certain features of all three craft, and could be readily fitted up by utilizing one of the unused colliers now on hand and deteriorating—the Lebanon for example.

This ship would need a wooden covered spardeck and a wooden covered maindeck. She should carry about 1000 tons of issue coal—two fills-up of seven commissioned boats of average coal capacity—paymasters' stores of all kinds needed by the boats, large supplies of oil and waste, and necessary engineers' stores, including the larger take-down tools belonging to the boats and heavier spare parts. A good amount of tankage and a good distilling plant would be necessary.

She should have a comfortable sick bay and a dispensary on

the main or spar deck; two or three regulation size brig cells on the main deck, a machine shop the size of the average one aboard a large cruiser but fitted with tools applicable to torpedo-boat work; a one or two crucible brass founding plant capable of handling castings for all torpedo-boat brasses except the heavier ones; and a small but applicable coppersmith plant. All these small plants could be readily accommodated on the main deck of a ship like the Lebanon and leave ample crew space for the ship's crew and room for occasional "rest details" from the boats' crews. The construction stores should include ample allowances of bottom, outside and inside paints, especially the preservatives, and small amounts of hull materials, plates, rivets, awning stanchion stuff, etc.

In equipment stores should be found ample amounts of good soft towing and mooring line stuff in the coil—4½-inch six-stranded Boston navy yard made manila for example—canvas for repairing awning and rigging rain-catchers, steel rope for ridge ropes and life lines, mess gear for fitting out recruits shipped aboard the base vessel, cooking utensils to supply losses and breakages, etc.

The supply of inflammables should be allowed, preferably on a six months' basis; at least for three months. The allowance of kerosene for cleaning grease out of boilers and machinery should be large enough to be used freely as a preservative. Turpentine allowance to correspond with paint allowance. Alcohol to be liberally supplied for shellacking the small crew spaces and officers' quarters of the torpedo-boats. The broaching tank system of stowing inflammable and explosive liquids on deck would be more convenient for frequent small quantity issues than the weather-proof package system, and has certain safety advantages in a ship with so small a crew as the base vessel would have, in that one man could broach all the tanks in a minute or two; with the package system the fire fighting of the crew would have to be slacked up while the necessary detail was getting the packages overboard. Inflammables afloat freely might be very disagreeable, but so would packages of inflammables. In a tide way or at sea both systems would work well when the stuff was once overboard. At slack water both would be highly objectionable.

For ships' boats the base vessel should have one good steam

cutter, capable of towing a 150-ton torpedo-boat handily, a couple of small ships' launches or strongly built cutters fitted with removable thwarts, for lightering stores, a couple of six-oared whaleboats and a dingy.

The cargo booms and derricks and her deck winches should be fitted for the work intended; but a very slight modification of the systems found aboard a collier would probably answer all purposes.

The foregoing outline of the salient points of a base vessel is sufficient to indicate her general character.

The great advantage of procuring stores in quantities sufficient for the seven torpedo-boats, and issuing them under one direction as needed is so much more economical than the single-boat supply method that it appeals strongly merely as an administrative measure, and apart from other apparent aids to efficiency that would follow from the use of a floating torpedo-boat base.

COMPLEMENTS AND RATINGS.

From what has preceded it is evident: that a torpedo-boat's crew should be made up in such a way as to be competent to handle the average boat of the flotilla efficiently; that it should have in it a number of nucleus crews for mobilization purposes, and that it should be so organized as to provide organizes subdivisions which in greater or smaller numbers taken from one or more boats in commission may make up a crew for any boat in the flotilla, large or small.

An inspection of the complement lists shows that the assigned complements are as follows:

	1	boat	56 men.
	1	"	53 "
22 boats	2	"	28 "
	14	"	26 "
	1	"	23 "
	3	"	21 "
	2	"	20 "
	4	"	13 "
	2	"	No complement assigned.
	30	boats.	

The 22 boats with assigned complements running from 20 to 28 men can all be efficiently handled by 25 men each, and can all berth those men when in commission, and therefore the changeable crew should consist of that number made up of four nucleus crews of five men each and five other men.

The two large boats and the six smallest ones should not be assigned to the cruising division at any time, because the large boats are too expensive and the small ones too small for coast work. In manning the large boats for practice running, each would of course have her own nucleus crew and would fill up with nine other nucleus crews, a chief machinist and chief gunner's mate from the cruising boats. The small boats would be taken out each by her own nucleus crew, one other nucleus and a couple of chief petty officers.

The nucleus crew should consist of five men, because there are five duties aboard a torpedo-boat, each of which requires an experienced man as instructor and illustrator when filling up complements with green men.

The ratings sufficiently explain the duties of the nucleus crew men as instructors, although, as must always be the case in torpedo-boats, the men below must do all-around work below, and the men on the deck the same. Gunners' mates, for example, must do the steering as well as lookout for torpedoes, etc.

A nucleus crew when fit for work as such should consist of 1 G. M., 1st class; 1 machinist, 2d class; 1 W. T., 1 oiler, and 1 fireman, 1st class *i. e.*, two engine-room men, two fire-room men and one deck hand, and the ratings should not go above these, though of course men when first taken on for nucleus crews could hold lower rates but should be capable of holding the rates mentioned after instruction or they would not be fit for nucleus men. The rates should not be higher, because the pay of those rates is sufficiently high for duties done in the running of commissioned or other boats. These rates are selected because the rates of pay are fairly uniform, as they should be, when the duties run into each other. For example, the oilers would have to do machinists' work and vice versa, the water-tenders would have to fire and the fireman pass coal, fire and tend water. And, moreover, there should be a certain amount of interchange of duties between the fireroom and engine-room men to make the nucleus crew what it should be.

The five extra men for a commissioned boat's crew should
1 chief gunner's mate, 1 chief machinist, 1 ship's cook 2d cl
1 steerage steward and 1 landsman mess cook. These five n
with four nucleus crews should make up the crew of a comm
sioned boat. Seven such crews would furnish nucleus crews
twenty-eight boats, and a chief gunner's mate or a chief
chinist to fourteen boats.

The complement of officers for each boat should consist
lieutenant in command and 1 subordinate officer, an ensi
naval cadet or gunner. Each officer to be detailed for one y
with a relief of either the commander or the subordinate ev
six months, so that after the system was in running order ev
commissioned boat would always have one officer with at le
six months' experience, and in two years there would be
perienced officers available for commanding officers of all bo

COMPLEMENT OF THE BASE VESSEL.

1 Chief master-at-arms.
1 Chief boatswain's mate.
1 Chief gunner's mate.
1 Chief carpenter's mate (wood and steel work).
3 Coxswains (quartermaster watch at sea).
3 Seamen (helmsmen at sea).
1 Chief machinist.
1 Machinist, 1st class.
3 Machinists, 2d class.
3 Firemen, 1st class.
3 Firemen, 2d class.
1 Boilermaker.
1 Electrician, 1st class.
1 Coppersmith.
1 Blacksmith.
1 Brassmolder.
1 Painter.
1 Shipwright (wood and steel worker).
2 Chief yeoman (1 pay and flotilla, 1 equipment and flotill
1 Yeoman, 1st class (nav., commanding officer and flo
writer).
1 Hospital steward.
1 Hospital apprentice.

1 Ship's cook, 1st class.
1 Ship's cook, 4th class.
1 W. R. steward.
1 W. R. cook.
1 Steerage steward.
1 Steerage cook.
5 Mess attendants.

And enough landsmen and coal-passers for passing coal, for mess cooks and for handling cargo as required by the particular vessel selected for the floating base.

OFFICERS FOR BASE VESSEL.

1 Commander, commanding flotilla.

Duty aboard base vessel for administration; aboard flagboat of cruising or trial division at sea and for all division drills.

1 Lieutenant-Commander, commanding base vessel.
1 Lieutenant.

Executive and flotilla construction, equipment and recruiting officer.

1 Lieutenant.

Chief engineer of base vessel and flotilla engineer. Should be a real engineer officer and preferably one who has had torpedo-boat experience.

1 Lieutenant, junior grade.

Navigator and flotilla ordnance officer.

3 Gunners.

Sea watch. Each assigned to superintend repair work of certain kind.

1 Assistant surgeon.

Flotilla surgeon.

1 Assistant paymaster.

Flotilla paymaster and storekeeper.

1 Pay clerk.
1 Warrant machinist.

Sea watch. In charge of machine shop and machine tool work in port.

Number and Kind of Men needed for Torpedo-B Service and Method of obtaining them.

The seven full crews each made up as shown of nucleus and extra men would require 175 men. The crew of th vessel would require approximately 65 men—240 men a to carry out the scheme outlined. The men for the to boat crews would have to be young, active, energetic an a good but not unusual amount of physical endurance.

The machinists and firemen of the base vessel, if no of her crew, should possess the same physical characterist as to make transfers to the boats upon occasion.

From the nature of the service and the consequent in bility of keeping up the kind of police restrictions usual on ship, all the men would have to be reliable as regards te to smuggle liquor aboard, and as regards drunkenness a In other words, all the men would have to be as relia these respects as perhaps 80 per cent of the men in g service now are.

All the nucleus crew men, the chief machinist and the gunner's mate of a torpedo-boat's crew, as well as a larg portion of the base vessel's crew, should have sufficient l edge of the use of machine and hand tools to make the r contemplated in the scheme. Therefore somewhat dif though not higher qualifications would be required of than of men of corresponding rates shipped for, or rated general service.

The men of the nucleus crews would have to be made men intelligent enough to progress to the higher rating they could not expect to reach these higher ratings be their duties in the boats would not warrant the expense because transferring them to ships where they might reac higher rates would defeat the prime object of the organizat the having at all times efficient nuclei for mobilization purp

Again, there should be a direct and efficient way of charging men found to be not adapted to torpedo se Some good men, for example, who are efficient aboard suffer so from seasickness in torpedo-boats that they are less for that service. It is evident that inducements to the torpedo-boat service must be found to offset the dep

tion of chance for higher rate and pay, and to make up for the harder work required, and for the lack of comforts.

To a great number of men in the country qualified for torpedo-boat duty, and surely to enough for the small number required, a particular service in which there was the esprit due to more or less selection and to the idea of desperate service in war—in which duty was confined to our own coast, and in which there was comparatively more individual responsibility, would present attractions that would fully make up for the disadvantages as compared with general service conditions, provided these attractions and the consequent stability of torpedo-boat service were assured.

For these reasons the men for the boats and base should be special service men and so shipped, or transferred; and in order to assure them that their status is secure when they are qualified, and to give an easy and direct method of sorting out the non-adaptable, their status should be more or less that of revenue cutter or coast survey men. It is to be observed that qualified men whose enlistment for three or four years in torpedo-boat service had expired, and who chose to ship for general service might be kept run of for mobilizations details. But these men, like qualified men who had given up the torpedo-boat service for shore occupations, while making for the possible number of qualified torpedo-boat men in the country for war service, could not be depended upon as attainable for quick mobilization of the whole flotilla.

After the system was in running order the recruiting for the torpedo-boat service should be done on board the base vessel, and after the system was developed the cruising division would be independent of dockyards for all repairs barring such as have to be made in drydock.

A few of the nucleus crew ideas might have more or less application to destroyers; but as the destroyer is theoretically a vessel of the fleet, while the torpedo-boat is a vessel of the mobile coast defense pure and simple, what applies to the one can have little application to the other, until there is a more general recognition of the fact that, after all, the two types are of one kind.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A LITTLE UNWRITTEN HISTORY OF THE ORIGINAL U. S. S. MONITOR.

By G. TOTTEN MCMASTER, M. D.

Associate Member Naval Institute, Associate Member Military Service Institution, Member of Connecticut Medical Society, Member of New Haven County Medical Society.

It is useless to dwell upon the events of the Merrimac's construction and the general consternation about its fancied ravages when floated. Suffice it to say that the Galena and Ironsides, though under construction, would not be ready to meet the southern monster.

The Navy Department and those in authority had been tormented by a flood of impecunious and vacuous inventors who for their own interests (let alone the nation's safety) dogged their steps persistently, and it is no wonder that when any idea was brought to their notice they were on their guard.

The man that I bring before the gentlemen of the navy in this sketch was neither officer, seaman nor marine. He was not in the battle, did not observe it, but was the power behind Ericsson, in that he first interested Secretary Welles and was the means of obtaining the money and iron.

Cornelius S. Bushnell, of New Haven, Connecticut, merchant, contractor and promoter, first put the Monitor in the way of being a fact and not a fad.

Bushnell had the Galena under construction, and while not yet finished, grave doubts were raised by naval experts as to her stability, viz., if she could carry such immense weight in armament and protection and yet be seaworthy.

Being alarmed at such frequent doubts expressed by naval men, Bushnell repaired to C. H. Delmater for advice.

This individual advised Bushnell to interview Ericsson hin self, giving the latter the requisite materials to draw up h calculations for results.

Acting on this counsel, Bushnell met the inventor on Thur day, October 17, 1861, Ericsson asking him to call next day t get his (Ericsson's) verdict.

So on Friday, October 18, 1861, Bushnell returned to ge his answer. The inventor's speech at this time was character istic: "She will easily carry the load you propose and stan a six-inch shot, if fired from a respectful distance." It wa at this meeting that Ericsson asked Bushnell if he could spar him a few moments, that he had a design for an impregnabl battery, that could be built and put into operation in 90 days

Bushnell listened with interest; he perceived the value of th little boat, and in a few words it was agreed that he (Bushnell should take the plans to the Secretary of the Navy.

At this time Mr. Welles was at home for a few days. Bush nell left New York, Friday, October 18, 1861, and went direc to the Secretary's house in Hartford, Conn.

Exhibiting the plans and model to Mr. Welles, who seeme interested, and requested his visitor to start for Washingto and bring it before the naval board, and that he (Gideon Welles would arrive in the Capitol in a few days and give Bushnell th contract.

The Naval Board at this time consisted of Commodor Joseph Smith, U. S. N.; Commodore Hiram Paulding, U. S. N. Captain C. H. Davis, U. S. N.

The plans had not been in Bushnell's hands 24 hours whe he had seen Secretary Welles and was on his way to Washingto (Saturday, October 19, 1861) to take the final steps.

Arriving in Washington, Sunday, October 20, 1861, Bushnel summoned the subcontractors for the iron of the Galen (Messrs. Winslow & Griswold) and divulged the design an plans of operation he intended to pursue.

Mr. Bushnell was aware that a plan so novel as a boat prac tically submerged would meet with strenuous opposition at th hands of the naval chiefs. The explosion of the Princeton' gun was as yet fresh in their memories.

After due deliberation the contractors determined to call upo Secretary Seward, request his influence and a letter to Presiden

Lincoln (this was on Monday, October 21, 1861). Obtaining a letter from Secretary Seward, they set out to interview the executive.

President Lincoln received Bushnell and his companions with his usual kindness, evincing some interest in the little model. He informed them that "he knew little about boats, unless it was a flat boat, of one of which he was master in earlier life." He assured the contractors that he had no power in the matter, that that was vested in the Naval Board, but he would meet them next morning (Tuesday, October 22, 1861) at 11 in Rear Admiral Smith's office.

At the hour fixed upon by Mr. Lincoln, Bushnell and the sub-contractors were at the Department. The model was presented and explained. The expected opposition was poured forth by old and young officers without stint, with the exception of Rear Admirals Smith and Paulding, the most powerful members of the board, who absorbed the situation and took in its merits and defects as only unbiased intellects can.

President Lincoln remained during the argument, which waxed heated at intervals, and listened with attention, not venturing much either for or against until Rear Admiral Smith asked his opinion.

Mr. Lincoln arose and observed: "All I have to say is what the western girl said when she put her foot into the stocking—'It strikes me there's something in it.'" Then with a courteous salutation to all present, the President left the apartment.

Rear Admirals Smith and Paulding were anxious to recommend its adoption if Captain Davis, the other member of the board, would consent, but the latter officer would not risk his reputation on the merits of this fanciful craft. All arguments that Bushnell and his fellow-contractors could bring to bear were of no avail.

A unanimous vote of the board could not be obtained, and Captain Davis, turning upon Bushnell with some little temper, exclaimed: "Take the little thing home and worship it; it will not be idolatry, as it is not like anything in the heavens above, or the earth beneath, or in the waters under the earth!"

Thus ended the interview. Sadly did Bushnell leave the department, with a heavier heart than he had carried with him for many a day.

In desperation he reported to Secretary Welles. Using his own words, which aptly described the situation, he says: "All was dark about me for an hour that Tuesday (October 22, 1861), but Secretary Welles cheered me up by saying that some influence should be brought to bear on Davis. I caught the idea and said if I could only get Ericsson to come to Washington himself to meet the board in Secretary Welles' room, the magnetism of Ericsson would carry all before him."

Bushnell was aware that Ericsson had taken a solemn oath never to set foot in Washington until the Government had paid his bill for the Princeton, and stated this fact to the Secretary. But nothing daunted, he determined if possible to make the inventor break his oath. Leaving Washington on Tuesday, October 22, 1861, for New York, Bushnell racked his brains for some means to shake Ericsson's strong resolve. At last he remembered the delight that the inventor had evinced when he (Ericsson) displayed a medal given him by Napoleon III.

Arriving in New York that night, Bushnell calmed himself for the ordeal by a well-needed night's rest, and at 9 o'clock Wednesday morning (October 23, 1861) we find him at Ericsson's home in Franklin Street, the inventor opening his own door and in excited tones asking: "What is the result?" "Magnificent," said Bushnell.

As this conversation is historical, I shall use Bushnell's own account. "Well," he said, "what?" I (Bushnell) said Paulding says your boat would be the thing to punish those rebels at Charleston. His countenance lit up. I knew then that I had him. I said, "You have a friend in Washington, Commodore Smith; he worships you. He says those plans are worthy of the genious of an Ericsson." Didn't fire come in his eyes? "You see how it works," I said. "Captain Davis wants a little explanation in detail, which I could not give." He (Ericsson) said "I will go to-day," and he started (October 23, 1861).

Bushnell remained in New York after this talk and awaited developments.

As events go by contraries in this world of ours, the very first person Ericsson met in the Department was Captain Davis. "I have come down," said Ericsson, "at the suggestion of

Mr. Bushnell, to explain about the plan of the Monitor." "What?" exclaimed Davis. "The little plan Bushnell had here Tuesday? Why, we rejected it in toto." "Rejected! What for?" inquired Ericsson. "For want of stability," returned Davis. "Stability," roared Ericsson. "No craft that ever floated was more stable than she would be; that is one of her great merits." "Prove it," said Davis defiantly, "and we will recommend it at once." "I will go to my hotel and prepare the proof," said Ericsson, "and meet your board in the Secretary's room at 1 o'clock" (Thursday, October 24, 1861).

At the appointed time, with his arguments well in order, Ericsson appeared. He succeeded so well that before he left the Department, Secretary Welles asked the price. $275,000 was the answer. The Secretary turned to Commodore Paulding and inquired: "What do you say?" "I vote to recommend the contract," was Paulding's answer. "And you, Commodore Smith; what do you say?" "I vote for it," said Smith. "And what do you say, Captain Davis?" "I vote for it," rejoined Davis.

"Then," said Mr. Welles, turning to Ericsson, "go home and start her immediately, and send Bushnell down next week for the formal contract."

Ericsson started for New York at once and arrived late the night of October 24. At the station Bushnell, Winslow and Griswold met him. A short talk and all was settled, for during the inventor's absence they had put all in readiness to start at the word, and now they did.

On Friday October 25, 1861, the keel of the Monitor was laid, even before the formal contract was signed, and on January 30, 1862, she was launched, just 106 days in all, counting Bushnell's work and the labor.

C. H. Delmater & Co. were given the construction of the machinery, engines and boilers. The hull and turret to T. F. Rowland. All engaged in the work put on extra hands and worked over time to finish the little boat.

The week of October 28, 1861, Bushnell went to Washington for the formal contract. To his dismay he heard the Naval Board predict "another Ericsson failure." They (the Naval Board) demanded a guarantee of perfect success for the boat, or a refunding of money already advanced. Unfair as the demand

The success of the venture needs no
set forth by far abler pens than min
part played by C. S. Bushnell in the
not generally known.

C. S. Bushnell in taking up the wo
through risked all he had in the worl
sight to make the Monitor a success
upon a desire for money, for he died

In order that this unknown patriot
in history, and that he may have his sh
is written.

Substantiations for all

The facts stated above are drawn
C. S. Bushnell. An address that he
fore Army & Navy Club of Connecticu
been drawn from largely; also a lett
Gideon Welles by Mr. Bushnell, recitin
asking corroboration of his statemen
former Secretary I append in full. A
mass of papers relative to the Monit
of his sons, Ericsson F. Bushnell and
New Haven, Conn.

One very peculiar thing about all
teresting paper is the lack of dates g
this deficiency, I have taken the date o
keel and the calender for the last half
Vol. 6, Series I, Official Records of the
Navies in the War of the Rebellion, an
in the speech of C. J. Bushnell above

when the keel was laid). To be sure, this is speculation, but I venture to say I am not far out of the way.

Item. "Report of the Secretary of the Navy in relation to Armored Vessels," Washington, 1864, page 6, I see C. S. Bushnell Co., of New Haven, is mentioned.

The original contract for the U. S. S. Monitor is doubtless accessible to all officers in the Navy Department, Bureau of Yards and Docks.

I append Secretary Welles' letter, as follows:

HARTFORD, 19 March, 1877.

C. S. Bushnell, Esq.

MY DEAR SIR.—I received, on the 16th inst, your interesting communication, without date—relative to the construction of the Monitor.

Many of the incidents narrated by you I remember, although more than fifteen years have gone by since they transpired. Some errors, not very essential and caused by lapse of years, occur—Sedgwick, not Rice, was chairman of the Naval Committee; Griswold resided in Troy, not New York, and subsequently represented the Troy district in Congress, etc., etc.

I well remember asking you to put in writing the facts in your possession concerning the construction of the Monitor. Some statements of General Butler, Wendell Phillips and others to disparage the Navy Department, prevent the truth and deny us all credit, led Admiral Smith, in the autumn of 1868, to address to me a communication, reciting the facts, for, he said, when we were gone those of us who took the responsibility and would have incurred disgrace had Ericsson's invention proved a failure, would be ignored and history mis-stated.

As you were more intimate with the case at its inception—were the first to bring it to the attention of the Department—it seemed to me proper that your recollections and knowledge of the transaction should be reduced to writing.

I am greatly obliged to you for the full and satisfactory manner in which you have complied with my request. Next after Ericsson himself, you are entitled to the credit of bringing his invention to the knowledge of the Department.

I would not knowingly do injustice to any one, and I am well aware that the official in the civil life and who in administering the government directs movements by which naval and military men acquire renown, is often by the passing multitude little thought of and scarcely known, but the truth should not be suppressed.

The civilians of the Navy Department, who adopted and pursued through ridicule and assault the Monitor experiment, Butler and others would slight and defame.

In the history of the war, the Navy Department which originated, planned and carried forward the naval achievements from Hatteras to

Orleans, and finally Fort Fisher, is scarcely known or mentioned. ...eroes who fought the battles and periled their lives to carry into ... plan which the Department devised have, deservedly, honor- ...membrance, but the originators and movers are little known. ... r, my dear sir, your earnest efforts in the early days of the ... ...e comfort they gave me. Yours,

GIDEON WELLES.

The above letter substantiates all above written, and C. S. Bushnell's sons can show it.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SMOKELESS POWDER

By Lieutenant Joseph Strauss, U. S. N.

The invention of smokeless powder marks an advance in the science of artillery ranking in importance with that of the breech-loading cannon. Measured by muzzle energy, the change in ordnance construction from cast-iron to steel has not contributed more to the improvement of artillery.

In 1852, seven years after the invention of gun-cotton, Captain Von Lenck of the Austrian army first made use of it as a propellant in guns. So far as smokelessness was concerned, he was of course successful, and its use continued in Austria for about ten years. In 1862, the gun-cotton factory was destroyed by an explosion and the manufacture ceased, notwithstanding the fact that the new powder had come into use to a considerable extent.

The gun-cotton as made at that time was unstable; no efficient means had been discovered for entirely freeing it from the residual acids used in the process of nitration; this difficulty was overcome by Frederick Abel who invented the process of grinding the cotton fibre in a paper-mill after nitration, thus reducing the minute tubes to short length and making it possible to remove the acid from their interior.

Von Lenck spun the gun-cotton and laid it up into ropes; this prevented its burning too rapidly, and when Abel overcame the difficulty of instability the material was no longer in a form that would permit its rate of burning to be controlled. About this time Captain Schultz of the Prussian Artillery nitrated wood cut into thin sheets and this powder has been used ever since for sporting purposes.

In 1886, Vieille produced the first practical military smokeless

powder, since however abandoned; this consisted of gun-cotton dissolved in ethyl ether and mixed with picric acid. In 1888, cordite was invented in England and has been used ever since.

Cordite is a mixture of 58 parts of nitro-glycerine with 37 parts of high-grade gun-cotton and 5 parts of vaseline. The gun-cotton is soluble in nitro-glycerine, but with difficulty, and to overcome this acetone is used as a solvent for both and then dried out. Ballistite, which is used in Italy and Austria, is very similar to cordite, only a different solvent is employed.

Cordite is squeezed out in a vermicelli press in smooth cords of varying thickness, depending upon the size of gun it is intended for. Its color varies from a light yellow to brown and the cords bend like vulcanized rubber and are about as hard to the touch as stiff beeswax.

There are only two general classes of smokeless powder in use; those consisting of a mixture of nitro-glycerine and gun-cotton as above described, and those consisting of gun-cotton alone, dissolved in a suitable solvent pressed into the desired shape and then having nearly all of the solvent removed by evaporation. The latter class are generally referred to as "gun-cotton powders." It is to this class that the Navy smokeless belongs.

The Navy powder is a solution of three parts by weight of soluble nitro-cellulose in two parts of ethyl ether and one part of ethyl alcohol. When mixed in a mechanical bread-kneader, the substance has the appearance of damp cornmeal. Under a pressure of a couple of hundred pounds per square inch, the solution is completed and the mixture has the consistency of stiff dough, small masses of it being translucent. From this stage it is pressed into suitable grains and nearly all of the solvent evaporated off. About one or two per cent. of alcohol remains in the powder, it being extremely difficult to expel the residual solvent to a lower point than that.

In the original Navy smokeless it was specified that the nitration should be in the neighborhood of 12.45 per cent; in other words, the nitrated cotton should consist of cellulose nitrates the mean nitrogen contents of which should be 12.45 per cent. Furthermore, all but two per cent should be "soluble." This word "soluble" is used in speaking of gun-cotton in a special sense. It means soluble in a mixture of ether and alcohol.

Prof. Mendeleef has demonstrated that a gun-cotton contain-

ing 12.44 per cent. nitrogen will give a greater volume of gas than any other. Experiments at Indian Head have proved that the nitrogen may be increased to as much as 12.80 without adversely affecting the velocity. Mr. G. W. Patterson has shown that owing to the impossibility of getting rid of all of the solvent the nitrogen should never be as low as 12.44. In the very smallest grains there remains never less than one-half per cent. This is probably nearly all alcohol and to provide for the oxidation of this it is necessary to increase the nitration, the amount of increase depending upon the size of grain, for the reason that the quantity of residual solvent is a direct function of the wall-thickness. However, about 12.80 is the highest nitrogen that can be obtained with a resulting solubility within the 98 per cent. demanded by the specifications; therefore, nitrations between 12.45 and 12.80 are permitted.

The amount of nitration depends principally upon the strength of the nitric and sulphuric acid used. With the very strongest nitric acid the result produced will reach as high as 13.1 in ordinary practical working. That would be insoluble military gun-cotton and only useful so far as we are concerned for mines and torpedoes. Such gun-cotton is easily soluble in acetone but the dried colloid where acetone is used as a solvent is brittle. The colloid produced by ether-alcohol is decidedly tougher and therefore much less likely to break up in the gun. For obvious reasons it is important that this should not take place.

In the powder manufactured abroad so far as we have been permitted to observe them, no effort is made to have the gun-cotton all soluble. Nor is it certain that such a result is necessary. With that condition thrown out it is easy to obtain high nitrations.

Physical Characteristics.—The Navy Smokeless powder varies in color from a light lemon to a deep brown, almost black. These variations in color depend generally upon variations in the process of manufacture, although the region in which the fibre is grown may have an influence. If pure clear water is used in the various processes of washing and boiling the gun-cotton the powder is clear or at least translucent. If the water is contaminated with iron salts the powder is brown and opaque.

The grains are about as hard as horn but not so tough. They can be readily turned in a lathe and take a fine finish. Minute

particles can be exploded by striking them with a hammer, l only the portion struck will explode.

The powder ignites at about 180° C. which is a considera lower temperature than that required to ignite black or bro powder. Notwithstanding this low ignition point, the mate is much less inflammable than black powder and this constitu a serious disadvantage which will be referred to later.

Ballistics.—It is certain that the powder is absolutely progr sive in its burning. When small charges are used with con quent low pressures and rates of burning, it frequently happe that partially burned grains are recovered in front of the mu zle of the gun. In all cases it has been observed that the o side diameter has been reduced and the inside diameter of t perforations increased in exactly equal amounts. The walls m be reduced to the thinness of paper, but the general structure the grain remains intact.

The two great advantages pertaining to smokeless powder a first, that the entire weight of the charge is reduced to g and becomes useful in propelling the projectile, and second, tl the target is not obscured by smoke. I have given second pla to the latter quality advisedly. As an example of the importar of the first point, let us compare the weights and velocities c tained with the 6-inch 40-cal. gun using brown powder a smokeless. A charge of 45.5 pounds of brown-prismatic gives this gun a velocity of 2000 f. s. with 15 tons pressure; twe pounds of smokeless gives the same velocity with 10.8 tons pr sure. If the pressure curves for the two powders were the sa in general form, this equality in velocity of the two powd would be unaccountable since the maximum pressure with t new powder is 28 per cent. less than the old. As a matter fact the curves are very similar and the area embraced by t smokeless curve is less than that contained in the curve of bro powder-pressures. In the latter case, however, it must be r membered that but about 35 per cent. of the weight of powd becomes gas useful in propelling the projectile; there remains per cent. in the form of smoke and residue left in the bore. Su pose 50 per cent. consists of smoke, that allows for about sev pounds of residue (which is undoubtedly an overestimate) a we then have the useful gas propelling a projectile weighi 100 pounds, plus about 23 pounds of inert products of combusti

in the shape of smoke, making a virtual projectile of 123 pounds weight.

The relations of weight, pressure and velocity given in the single instance above do not always hold good. The powder must have a wall-thickness exactly suitable to the size of the chamber and length of the bore or else all of the powder will not be consumed in case the powder is too thick, or in case it is too thin the powder will burn rapidly and the pressure will be too high. The one case makes the chamber end of the gun do excessive work and the other throws the strain on the chase and muzzle. Thus, it is quite as important to the safety of the gun not to have too low a maximum pressure for a given velocity as to have one that is too high.

In guns fifty calibers in length with chambers large enough to accommodate a charge having about 45 per cent. of the weight of the shell, a velocity of 3000 foot-seconds is obtained with a pressure of 16.5 or 17 tons per square-inch. These results have been obtained with a 6-inch gun of 46 calibers. A velocity of 3380 f. s. was produced in a 5-inch 50-calibre gun, the shell weighing 50 pounds, the resulting pressure having been 15.8 tons. With a 60 pound shell the velocity was 3200 f. s. using a charge equal to that employed in producing the higher velocity with the lighter shell. In the latter case the pressure was 18 tons and the smaller amount of energy produced in the former can only be accounted for by the presumption that the powder was not all burned up, a result that would be produced when the pressure was too small to keep up the rate of burning. This of course was due to the lighter projectile moving forward under a lesser impulse than was required for the heavier.

Considerable disappointment is felt that the discharge of a gun using smokeless powder produces so much smoke. The powder-charge proper is really smokeless, the only smoke produced coming from the ignition charge. The lack of inflammability of the powder renders the employment of the ignition charge indispensable. For a 6-inch charge 100 grams of fine-grained black powder is about the least amount that will insure proper ignition. For a 13-inch charge weighing 300 pounds, a 14-pound ignition charge is used. Relatively the 13-inch charge requires something like seventy times as much black powder as the 6-inch. With the latter, the smoke does not obscure the target

at all, but the smoke from the 13-inch is considerable. Fortunately it is so intermixed with the large volume of colorless gas that it dissipates readily enough not to seriously hamper the aiming. At the Proving Ground it was found that a point four miles distant was visible in five seconds after firing the 13-inch loaded with smokeless; with brown powder the time taken was twenty-five seconds; this was in calm weather; with anything of a breeze the five seconds would of course be lessened.

All attempts to reduce the amount of black powder result in decreased velocities, long hang-fires and increased pressures. The first is probably caused by not having all the powder consumed; it can be remedied by increasing the smokeless charge, but this not only increases the expense but probably burns powder in the wrong part of the gun. The hang-fires could not be overcome and they would be long enough to interfere with good shooting. The increased pressures are due to igniting a portion of the charge first, and setting up "wave-motion" by the released gases balloting back and forth from one end of the chamber to the other thus getting the dynamic effect of their weight.

It is necessary to fill the entire chamber with flame so as to instantaneously ignite all portions of the charge at once to avoid these effects and, so far, fine black powder is the only substance that has afforded the necessary inflammability to accomplish the desired result. It naturally occurs to one that smokeless powder so finely divided as to have a large amount of burning surface would be sufficient. This has been tried using all varieties of fine-grain smokeless including shot-gun powder, pistol-powder and even powder dust.

In the 6-inch the substitution of 50 grams of 60 mm. smokeless for the regular 100 grams of black powder has resulted in an increase from the normal pressure of 16 tons to the high one of 20 tons; and this with a perceptible hang-fire.

Stability.—The powder being nothing but gun-cotton with a small percentage of alcohol and a trace of ether included in the mass, its stability depends on the stability of the gun-cotton. That of course in turn depends on the purity of the gun-cotton. This substance has a long and favorable history, and when it has failed in keeping qualities the failure has always been due to imperfect preparation.

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SUBMARINE BOATS.

TACTICAL VALUE AND STRATEGICAL CONSIDERATIONS.

(Extract from a lecture delivered at the War College, September 13, 1901.)

By COMMANDER W. W. KIMBALL, U. S. Navy.

TACTICAL VALUES.

The chief of these owes its existence to the fact that the approach of a boat under water cannot be stopped by gunfire, and that therefore sure torpedo range can be reached in daylight in spite of gunfire, per se. Since the boat at a working depth of from thirty to forty feet cannot satisfactorily direct her course upon an object constantly changing its position, and since a ship can not only change her position, but can change it at a speed much greater than that possible for the boat, it is evident that the ship could keep out of torpedo range after sighting the boat or otherwise becoming aware of her being in the vicinity before she got home, just as a fast cruiser can keep out of gun range of a battleship. It is very generally concluded that a battleship has a considerable tactical value when opposed to a fast cruiser because within her more limited area of effective action the former can, owing to her strong defensive power in armor and her strong offensive power in gun fire, compel the latter to move out of that area. Just so, owing to her invulnerable defense of water cover and the strong offensive power of her torpedoes, can the submarine compel the battleship to move out of the very closely limited area of effectual action of the boat.

The differences, then, between the tactical values of battleships

versus cruisers, and submarines versus battleships are those of degree rather than those of kind; and therefore if a battleship be very good against a cruiser a submarine must have some tactical value against a battleship.

The chief factors that define the boat's degree of value are small radius of effective operation, slow speed, indirect approach when invulnerable to gun, torpedo and ram attack, and the necessary giving up of complete invulnerability from time to time for the sake of correcting direction of approach.

From the data given in the table * it would seem that while the radius of movement calculated for is about 400 miles—though why this distance should not be quadrupled by utilizing ballast tanks for fuel stowage I cannot conceive—the radius of effective operation, i. e., the distance through which the boat could move in continuous diving, i. e., fighting trim at full speed, is less than thirty miles.

Reducing this distance by the good margin of 33⅓ per cent and making it twenty miles we arrive at a figure which seems to place the boat in the mobile coast defense,—in the offensive-defensive not in the harbor defense class—and to determine the distance off shore from which she could fight all the way into the beach. She could, of course, exhaust her submerged or fighting endurance in one continuous effort, or could come to the surface at a safe distance from the enemy and renew her submerged-running power, or could guard a position all day by using her under water power economically, according to circumstances. With the radius of effective fighting operation fixed at twenty miles, the effect of slow speed becomes apparent. For example, it is clearly seen that if a 14 K. battleship avoided a single 7 K. submarine twenty miles off shore and ran close in, she could operate there about an hour and a half before the boat could arrive and drive her off.

With a number of boats holding a line against the advance of a number of ships the disadvantage of slow speed is greatly lessened, as will be seen if we suppose that a line of 7 K. boats with six mile intervals opposed the advance of 14 K. ships whose direction of approach can be made out at six miles. If the ships came on in column the boat nearest ahead would close to inter-

* Omitted.

cept; and since the greatest distance that a boat would have to move through to do this would be half the interval, equal to half the distance the ship would have to move to reach the point of crossing the line, it is evident that as far as speed alone is concerned one or two of the 7 K. boats could reach the point of interception and make matters very interesting for the leading ships; while the ships that succeeded in passing the line would be in the best possible position for the boats to close on and force a second passing of their line by making the inshore region too dangerous for occupancy.

As before, the ships that got through the line could operate inshore for an hour and a half, if, as supposed, all available submarines were put on the line, and none held inshore, in reserve. If the ships came on in line or group formation the boats would of course have a greater number of chances for successful work.

In regard to the defect of indirect approach, it is to be noted that this only becomes serious in long submerged runs, and that tactically, there is no reason or excuse for such runs in the attack upon ships. Such long underwater runs would only be useful when hauling off after the torpedoes were expended.

In manoeuvring for position as just supposed the boat would be steered by continuous direct vision till within 6,000 yards or less, at which distance the chance of striking an indistinct target a few inches high at quickly changing ranges from a ship moving at speed may be considered nil. After that and until the ship were within 2,000 yards the dives would be short and the bearing well kept; for it may be taken for granted that the chance of scoring by the guns of a ship moving at 14 K. is practically nil when the object aimed at is a water tinted cylinder a few inches high that disappears for three or four minutes and appears for not more than ten seconds at a time and at a different place each time. If the ship is heading across the boat line, as supposed, the captain of closing boat will know that she will cross the line in from four to five minutes from the time she is a mile away, that the boat will in that case be within sure torpedo range of a broadside target within that time, and so will not stay down more than three minutes. If the ship holds her course the boat will have a sure shot as she breaks water; if the ship changes her course a few points either way the chance for one or the other of the closing boats is still good; if the ship puts her

helm hard over and goes about the chance is not good, though with hard over helm the ship would present a fair target at from 1300 to 1500 yards, which with Obry gear and the torpedo really kept in order, would be worth trying for. In this case the loss of a sure shot is due, not so much to the boat's lack of direct approach as to the superior speed of the ship in running away, and it may be remarked that if the ship runs away, the boat has accomplished something. Only when the boat rises within sure torpedo range—400 to 500 yards—does the ship have a practical chance of sinking her; and not then before her torpedo is away. To sink her a fair hit with at least a 4-inch would be necessary—and the gun practice that could be relied upon to do that in ten or fifteen seconds would have to be rather fine.

I have gone into this matter of method of approach, ad nauseam perhaps, because for some reason that I cannot comprehend, there exists, even today, a widespread idea that since a submarine can dive she must necessarily remain under water and blindly grope about there; and that if she does not do so she must be hampered with much befogging terms as submersible, or immersible or emerger or submerger, terms full of sound and signifying less than nothing at all. One hears even in the year of grace 1901, expressions of pseudo-expert opinion to the effect that submarines can never be useful until some method of seeing under water is arrived at. While under-water vision would greatly add to the tactical value of the submarine, provided she possessed this quality and her surface enemy did not, it is sure that, if she could see under water only at the expense of being seen, her utility would be less than it now is, since she could not conceal herself in short dives and could, much more easily than now, be struck by surface craft as she rose for a shot whether she broke water with her conning tower or used a camera lucida or periscope.

The sumbarine is slow always, and intermittently she is blind; but she has speed enough to be useful when working on interior lines against fast surface craft, she does not altogether lose sense of direction when she becomes blind for the sake of becoming invulnerable and she possesses the enormous tactical advantage of that third dimension movement which is denied to surface craft. She can move out of their field of action without going away—or into it at will.

In one of the late British Service Journals there is a statement to the effect that a destroyer stripped of gun and tubes and equipped with a stern towed spar torpedo on a forty foot boom could destroy a submarine by towing a boom against her when she was ten feet under water. Why a submarine should run at ten instead of thirty or forty feet does not appear; nor does it appear how the destroyer could, when the submarine showed for a few seconds, head for her and strike her with the spar torpedo before she attained a safe depth. While the battleship, protected by the destroyer is the proper quarry of the submarine, there seems to be no law against sinking the destroyer in passing if her presence were inconvenient.

Personally I am strongly of the opinion that the primary tactical use of submarine will consist in keeping hostile ships fifteen or twenty miles away from the defended place, in preventing them from passing through points at bombarding ranges, and upon occasion forcing such an extension of the blockading line as to make intervals wide enough for the safe passage of a contained fleet or of merchant craft—in short in making blockades non effective no matter what the force employed. That submarines could do this duty within the area defined, seems clear because within that area it would not be war or common sense to expose expensive ships with large crews to the attack of submarines with small crews, when the chances of war were so largely in favor of the boats. The tactical disposition for this primary use has been sufficiently indicated. It would be such that while there would be a certain concert of action, each boat would have to manoeuvre independently under general orders to close and strike when possible.

There exists a considerable weight of authoritative opinion in favor of carrying small hoist-in submarines, aboard battleships and large armored cruisers. Small non autonomous submarines—I mean boats incapable of recharging their storage batteries from motors worked on board—as light as 15 tons weight can be constructed and might have a certain tactical value when a weak fleet had to meet a superior one at sea, since the hoisted-out boats might form a rather comfortable line of defense for the weaker fleet to fight behind, or upon occasion to retreat behind.

But the hoist-out boat does not appeal to me because the

weight and space devoted to boat carriage would considerably detract from the fighting qualities of the battleship under the more frequent conditions of battle. While all other classes of fighting craft should sacrifice efficiency in a particular direction in order to become a better auxiliary to the battleship, not one iota of the latter's power should be reduced in order that she might better aid other types. If a defensive line of submarines were considered useful to a fleet under special conditions, it would seem better to tow a string of coast defense boats by a convoyed steamer. Submarines can be sealed up and towed for any length of time and they tow well and easily without steering. The crews could board them on balsas in a seaway and have them ready for work quicker than the smaller boats could be hoisted out, and could in fact board them in a sea in which the hoisting out of the carried boats would be a slow and difficult if not impossible operation. The idea of hoisting out submarines in the face of the enemy seems ridiculous. It would seem to me too, that for the attack of ships, dry docks, etc., inside a defended port, the towed or self navigating coast defense boat would be much more efficient than the small hoist-in boat.

I would ask you to receive these personal reflections with a large amount of salt, for I am fully aware that my predilection for homogeneity in type of all classes of fighting craft may prevent a proper view of the advantages of two or three kinds of submarines for two or three kinds of work.

With submarines in the defense of a contained fleet the temptation to use them by the containers would be great; for although the defensive submarines could drive off the surface craft of the latter, they could not prevent the containing submarines from closing to prevent the egress of the contained fleet. At present no one knows how much service submarines may be capable of in distant operations; while their proved efficiency shows what may reasonably be expected of them in the coast defense.

Mahan tells us that "Effective defense does not consist primarily in the power to protect but in the power to injure." The submarine surely has the power to injure in her torpedoes and she has sufficient mobility and sufficient invulnerability to make that power felt within the narrow limits of her coast defense work. If we admit that within the twenty miles off shore limit she may be effective, it follows that certain strategic

movements at present considered correct must be broadly modified.

Strategic Considerations.

From what precedes in the discussion of tactical values, it follows that strategic movements for the purpose of blockade of ports, bombardments of places, or containments of fleets cannot be initiated with confidence of success when there are mechanically effective, well organized and well handled submarines in the defensive and none in the offensive.

Also that submarines would hamper fleets more or less, if they were taken along for deep sea fighting, but as they might be useful as a sort of unattackable and quickly placed mine line to fight behind at sea, their presence or absence would influence strategic conclusions.

In regard to the question of bases for occupation upon a hostile coast, it is apparent that the strategic selection would be modified by the necessity for protection against submarine boat operations—that a base otherwise available would be rendered untenable by the presence of the enemy's coast defense submarines.

For example:—Since deep water channels cannot be held by mines or by gun fire against submarines because mines in any channels practicable for ships can be readily attacked or passed by submarines, movable obstructions or other devices would have to be resorted to to insure a safe defense and this necessity would directly influence strategic selection.

Again, with submarines in the defensive and none in the offensive of a base—which will be the usual condition if submarines cannot be used on extended campaigns—the strategic desirability of multiple exit is lessened, since the containing fleet could be pushed so far off as to make one exit as desirable or more within the limit of effective operation of the boat, i. e., two exits twenty miles apart would be only a very little better than one. Two or more exits so far apart that the distance between them was considerably greater than the radius of effective action of the boats would retain a part of their value assigned them when only surface craft are considered. With submarines in both the offensive and defensive—i. e., under the supposition that submarines can be taken across seas—the multiple exit holds

its value in kind, though less in degree, than when estimated for upon a surface craft basis.

But the chief strategic value of the submarine, the value which nearly all naval services but ours recognises, is the limitation she imposes on coast operations by the enemy in the absence of the home fleet, through her power to meet any class of hostile ship upon the coast by day or night with the chances of success in her favor, and through her power of numbers, due to small cost of construction and maintenance, to cover long stretches of coast.

That country most needs the submarine which has the greatest number of wealth centres that may be operated against in the absence of the cruising fleet and which may be forced to send practically all her fleet abroad.

That country is ours in the opinion of a high English Naval Authority, whom I quote:—

"Let us suppose," he adds, "that in time of war 100 French submarines are let loose in the channel at night. These boats have sufficient speed and radius of action to place themselves in the trade routes before darkness gives place to day, and they will be capable of doing almost incalculable destruction against unsuspecting and defenceless victims. The same possibilities apply to the Mediterranean and to other of our ocean highways within the danger zone of the submarine. The submarine boat has thus increased the value of the mechanical torpedo tenfold. To the United States of America it will be of inestimable benefit, as it will render the coast practically secure against attack from any country excepting those having naval bases within easy striking distance of their littoral."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

LETTER FROM HOWARD E. AMES.

SURGEON, U. S. NAVY.

U. S. S. MASSACHUSETTS,
AT SEA,
OCTOBER 5, 1901.

THE SECRETARY AND TREASURER OF THE U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

Sir:—In Vol. XXVI, No. 4, of the Proceedings of the U. S. Naval Institute, 1900, is an article, "A Stretcher for Wounded on Board Ship," by Lieut.-Comdr. Dennis H. Mahan, U. S. Navy.

As a matter of history, I send you this for publication.

I designed and have used the same stretcher for the past nine years. The first one made was on the U. S. S. Montgomery in 1893. The second and third on the U. S. S. Detroit in the same year; they were used by me during that whole commission in China and until the Detroit returned to the United States. Straps were first used, but were discarded for a simple lashing, as the straps dragged on the deck, were not tidy, and were trodden upon when used in drill. The coil of lashing was kept in the place assigned for the stretcher. Medical Director Ayers, Fleet Surgeon, Asiatic Station, in his inspection of the ship, commented upon its simplicity.

My idea in designing it was to secure a rigid splint for the whole body, so that no matter what part sustained injury it could be transferred without movement and least discomfort; its narrowness was to admit of its ready transit through watertight doors and small hatches of our modern ships. The but-

tock strip and foot-rest to prevent the sliding of the patient when passed down hatches or into boats.

The simple lashing is preferable to the fixed straps; it can be adjusted to prevent pressure over the seat of injury and variation in size of patients.

The first one of these stretchers I saw other than those I had made is the one now on board this ship; it was brought to this vessel by Dr. Bogert, U. S. N., from the New York. I immediately recognized it, but was surprised and astonished when informed it was called the "Mahan Stretcher." Afterwards I saw an article by Medical Inspector C. U. Gravette, U. S. N., in the Proceedings of the Associations of Military Surgeons, giving Mahan the credit, and later, the article in the Institute Proceedings.

Lieut.-Comdr. John L. Gow lately suggested a valuable improvement in making the buttock strip adjustable to allow for the variation in the length of legs.

Very sincerely,

HOWARD E. AMES,
Surgeon, U. S. Navy.

DISCUSSION.

Captain Chadwick's Letter Relating to the Training of Seamen.

See No. 98.

Captain Caspar F. Goodrich.—The question with which Captain Chadwick deals is as old as the substitution of steam for sails in the primary motive power of ships. To this question, complete differentiation of labor will, of necessity, furnish the answer to those who look for material results only. Nothing can be more satisfactory than an organization in which each man's task, assigned in exact proportion to his strength and capacity, is performed day in, day out, with ceaseless regularity. Were vessels always to sail under sunny skies over smooth seas, unvisited by tempests and fogs and enemies, such a system would find no serious opponents, scarcely even an adverse critic, except among those perennial shell backs, the *laudatores temporis acti*. They would, indeed, have no real ground for their strictures—not a leg to stand on. As the sailor phrases it; under such circumstances, all the old women would be going to sea.

But, and this seems to me the gist of the whole matter, our organization should not consist exclusively of specialists, helpless in the presence of phenomena different, either in kind or in great degree, from those with which they are habitually concerned; rather should it comprise, in adequate numbers, men of sagacity, boldness, of training and experience in emergencies, when the best of *physique* and *morale* is none too good. It is when the tempest rages or the rock-bound coast, close at hand, is shrouded in a veil of fog, when death looms sudden and awful in a collision, or the lives of fellow human beings hang on the adroit tossing of a rope or the powerful and skillful handling of an oar, when in the thick of battle, men have to think for two and act for six all at once, that any naval system is tested to the breaking point. If we have failed to provide men able to meet these and other exacting contingencies, then we have failed in our duty.

It can hardly be asserted that, hitherto in the history of our navy, the call has not found the right man. If that be so, we must admit that our honorable record has been made by men who got their nautical training in sailing ships. Surely, if experience counts for anything, we should be slow in abandoning the old ways which have confessedly worked so well.

Captain Chadwick would be quite within his logical rights if he simply took the ground that the burden of proof rests, not with him, but with the innovators. He might, very properly, invite them to carefully study the practical and undeniable outcome of the old method and challenge them to show how, in any other way, the man-of-wars-man, that ideally handy man of "courage, resourcefulness, activity, strength," can be better, more rapidly or more economically produced than on board a

sailing ship. Until then, I shall be content to adhere to my c
so well expressed by Captain Chadwick, and to endeavor
mild sense of resentment towards those who, in advocating
new and untried, would hold us, of the old school, to a den
of the efficacy of its processes, calmly ignoring the fact tha
is to-day what it is because of what it has been. Paraphras
known epitaph he might say with entire appropriateness, " Si
tionem queris, circumspice."

PROFESSIONAL NOTES.

Prepared by Lieutenant L. S. VAN DUZER, U. S. Navy.

For convenience of reference these notes are arranged as follows:

A. Notes on ships of war, budgets, and personnel, the notes appearing under the head of the naval power to which they refer. Alphabetical arrangement is followed.

B. Miscellaneous Notes on Armor, Ordnance, Explosives, Torpedoes, etc. The arrangement is alphabetical and the principal heads are:

1. Ammunition.
2. Armor.
3. Boats.
4. Boilers.
5. Canals, Harbors, and Waterways.
6. Coaling Ship.
7. Coast Defense.
8. Communications.
9. Construction.
10. Docks.
11. Electricity.
12. Engines.
13. Fortifications.
14. Fuel.
15. Gunpowder and Explosives.
16. Guns.
17. Guns: Firing.
18. Guns: Mounts.
19. Instruments Used in Action, etc.
20. Machinery (auxiliary engines), etc.
21. Operations (war or manoeuvers).
22. Propulsion.
23. Small Arms.
24. Strategy and Tactics.
25. Torpedoes.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

ARGENTINA.

GUNBOATS: BUILDING.—Two gunboats of 709 tons and 17 knots speed are reported to be under construction at Buenos Aires for the Argentine Navy.

BATTLESHIP ORDERED.—On account of trouble with Chili, the Argentine government has, it is reported, ordered, or purchased, a battleship in Europe. The displacement is stated to be 11,000 tons.

AUSTRIA.

REORGANIZATION OF DEPARTMENT OF MARINE.—It is interesting to observe that the Austrian navy department, which is a branch of the ministry of war, has just been reorganized upon a plan closely resembling that advocated by Lieutenant-Commander John Hood, U. S. N., in last year's prize essay, published in PROCEEDINGS No. 97. While the navy department still forms a part of the ministry of war, it has been formed into an autonomous section under control of a vice-admiral, who is commander-in-chief of the fleet and marine forces, and who will represent the minister of war in the discussions of the budget of the navy department. A superior officer of the fleet will take the vice-admiral's place in case of absence through sickness or other cause.

The Section of Naval Affairs will consist of:

(*a*) The Marine Cabinet: Has charge of affairs reserved from control of bureaus; directs the personnel; issues orders to officers; directs movements of fleets and controls the military service in general; has charge of schools; and controls the hydrographic and medical services.

(*b*) The General Staff: Has charge of plans for war, mobilization, constitution of naval forces, etc.

(*c*) Service I, consisting of—
Bureau 1. Personnel: officers.
Bureau 2. Personnel: petty officers and other enlisted men.
Bureau 3. Administrative matters connected with Service I.

(*d*) Service II, consisting of—
Bureau 4. Naval construction, machinery, and ordnance.
Bureau 5. Auxiliary (non-military) vessels, naval works, etc.
Bureau 6. Administrative matters connected with Service II.

(*e*) Bureaus not belonging to Services I or II—
Bureau 7. Administration of justice.
Bureau 8. Administration of funds and accounts in general.

The Cabinet, the General Staff, and Bureaus 1, 2, and 4 are presided over by officers of the General Staff; Bureau 5, by a military engineer; Bureaus 3 and 6, by superior officers of the commissary department; Bureau 7, by an advocate general; and Bureau 8, by a commissary general.

ARPAD: LAUNCH.—The battleship Arpad, 8340 tons, was launched at Trieste, September 11, 1901. The vessels of this class are fully described in PROCEEDINGS No. 97, page 151.

BRAZIL.

SUBMARINE BOATS.—Much interest is being taken in submarine boats by the Brazilian navy. A naval engineer by the name of Luis Jacintho Gomes recently tested a model of a submarine on the design of which he is reported to have been engaged for ten years. A newspaper of Rio de Janeiro states that the minister of marine has ordered a boat of the Gomes type to be built at the arsenal. Its principal dimensions will be: Length, 20 meters (65.6 feet); beam, 2 meters (6.56 feet); displacement, 40 tons. The propelling power will be an electric motor of 15 horsepower. The armament will consist of several automobile torpedoes. The complement is four men.

A model of a submarine boat designed by Senhor Mello Marques, late lieutenant in the Brazilian navy, is reported to have a successful trial. The model was less than a meter in length and the trials took place in a small experimental basin. The boat is provided with automatic apparatus for keeping the axis in a horizontal plane at all times, and it is submerged and brought to the surface always in this position. A full-sized boat is to be built.

CHILE.

ALMIRANTE SENORET: LAUNCH.—This small vessel was launched at Valparaiso (or Talcahuano) on October 15. No details have been published.

TORPEDO-BOAT DESTROYERS PURCHASED.—A dispatch from Buenos Aires to the New York Herald, dated December 4, says that the Chilian government has purchased from Messrs. Laird, of Birkenhead, two torpedo-boat destroyers. The purchase price is stated to be £70,000.

COLOMBIA.

LA POPA: FOUNDERED.—The little Colombian gunboat La Popa foundered on a trip from Savanilla to Cartagena. There was a company of soldiers on board at the time. The only persons saved were four sailors.

DENMARK.

SINKING OF THE MÖEN.—On September 30, the Danish gunboat Möen was sunk near the Middle Ground, Copenhagen, by the explosion of a high-explosive shell. The vessel was at gun practice with Prisant shells, but the crew was removed before the gun was fired, so that no one was injured. The Möen is an iron gunboat of 400 tons, launched in 1875, and carrying a 10-inch Armstrong muzzle-loading rifle and two Krupp 3.4-inch guns.

FRANCE.

PROGRAM FOR 1902.—The budget committee of the French Chamber of Deputies has the budget under consideration and it will probably be some weeks before action by the Chambers is taken on all points. The budget committee has declined to sanction any increase of officers or men, though there is an evident shortage of both. It has also refused the small vote asked for commencing work on battleships 12, 13, and 14, the last three of the six provided for in the program, and which were to be laid down this year. The committee says that the small sums asked would be insufficient for any real progress. The minister of marine is therefore unable to prepare plans, make contracts, or do any preliminary work on these ships. Full details of the budget, as submitted by the minister of marine, have been published; but as there are to be so many changes, the compiler defers publication until the amended form is known. As stated in PROCEEDINGS No. 99 (page 588), the total amount of the budget as submitted to the Chambers was 312,097,951 francs ($60,234,904.54; 1 franc = $0.193).

SHIPS COMMENCED IN 1901.—Early in August the minister of marine published a list of all ships commenced during the past year, viz.:

Two battleships: République and Patrie. An armored cruiser: the Victor Hugo. Ten torpedo-boat destroyers: Francisque, Sabre, Dard, Baliste, Mousqueton, Arc, Pistolet, Bélier, Catapulte, Bombarde. Twenty submarines: Naïade, Protée, Perle, Esturgeon, Bonite, Thon, Souffleur, Dorade, Lynx, Ludion, Loutre, Castor, Phoque, Otarie, Méduse, Oursin, Grondin, Anguille, Alose, Truite. Twelve torpedo boats of first class: Nos. 266 to 277.

In addition to these there have since been laid down, or ordered, the armored cruiser C_{14} and three experimental submarine boats.

ARMORED CRUISER C_{14}: ORDERED.—The construction of this armored cruiser has been ordered. The original program provided for her building at Cherbourg, but this is changed by the recent order and she will be put on the stocks at the Brest arsenal. She will be a sister ship

in all respects to the Victor Hugo, fully described and illustrated in PROCEEDINGS No. 98, page 384. Her name, it is said, will be either Thiers or Lamartine.

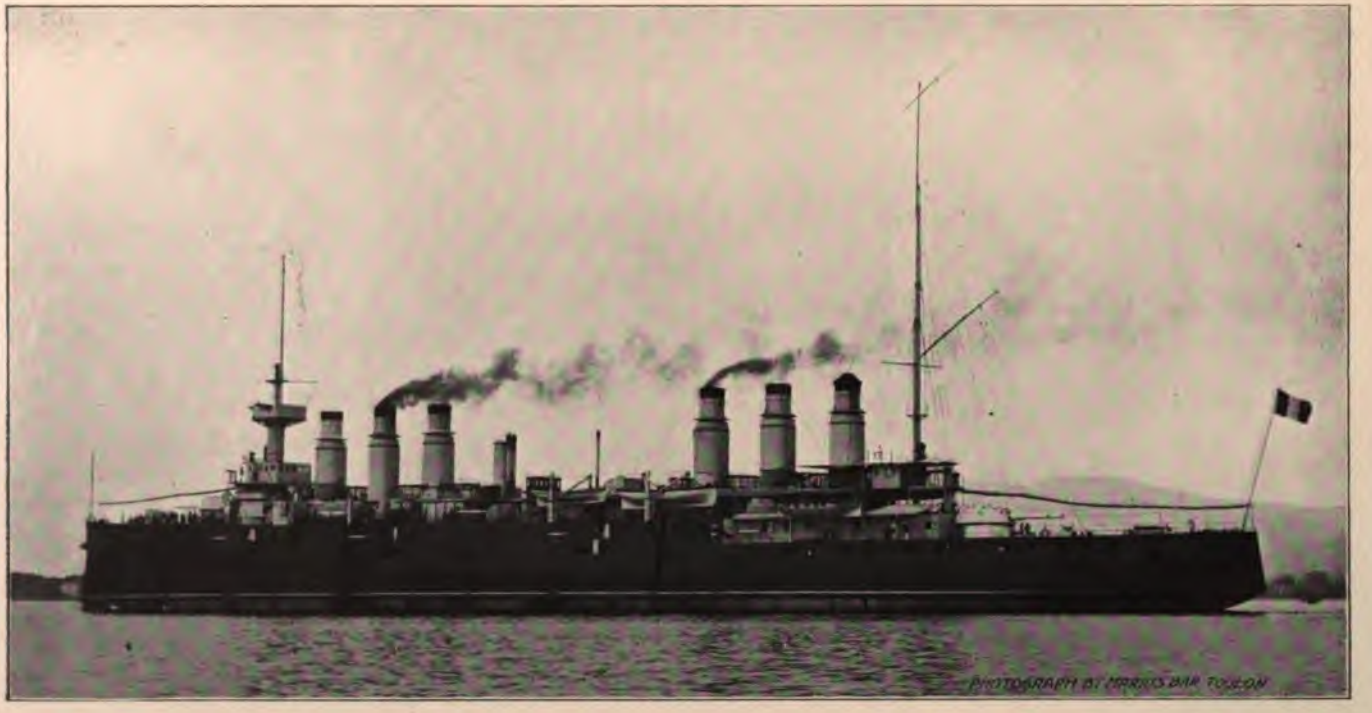
LEON GAMBETTA: LAUNCH.—This first-class armored cruiser was launched at Brest arsenal, October 26. She is a sister ship in all respects to the Jules Ferry, building at Cherbourg, to C_{14}, just ordered at Brest, and the Victor Hugo, building at Toulon. The Victor Hugo is fully described and illustrated in No. 98, page 384.

JEANNE D'ARC: UNSATISFACTORY TRIALS.—The trials of this armored cruiser of 11,270 tons have been most unsatisfactory. She was designed for a speed of 23 knots with 1400 tons of coal on board; but, up to the present, a speed of only 18 knots has been reached, although considerably less coal was carried. At full speed the engines are supposed to make 120 revolutions, but at 110 revolutions the bearings heated to a most unusual extent. In addition to these troubles the temperature of the fire-rooms is so high as to be unbearable. A special inquiry is to be held, and it is reported that her boilers may have to be removed and others substituted. The Jeanne d'Arc is fully described in PROCEEDINGS No. 96, page 701, and a full page illustration faces the preceding page in the present number.

MONTCALM: TRIALS.—This armored cruiser of 9517 tons has completed her preliminary trials and attained a speed of 20.85 knots on the measured base off the Iles d'Hyères. The horsepower developed was 18,200. The designed speed is 21 knots with 19,6000 I. H. P. According to *Le Yacht*, the temperature of the fire-rooms was not abnormal and the machinery behaved in a highly satisfactory manner; but the *Moniteur de la Flotte* states the authorities are much disturbed over the high temperature of the fire-rooms, which was quite intolerable. The Montcalm belongs to the same class as the *Dupetit* Thouars, fully described in PROCEEDINGS No. 97, page 590, from which ship she differs only in her boilers. The latter are of two kinds, 4 of the Normand type and 8 of the double Normand-Sigaudy. The illustration of the Montcalm which faces this page is from a photograph taken during the past summer.

CHATEAU-RENAULT: TRIALS.—The final trials of this protected cruiser of 8018 tons (metric) took place in the latter part of August, and were regarded as satisfactory. The trials consisted of three runs over the measured base with the following results: 1st run, speed 24.043 knots; 2d run, speed 24.324 knots; 3d run, speed 24.067 knots. Mean speed, 24.148 knots. The mean I. H. P. during the trial was 23,680, and the maximum, 24,964. The designed I. H. P. was 23,000, corresponding to a speed of 23 knots. While the trials were regarded as successful, the heat in the fire-rooms was unbearable and no means has been suggested of remedying this defect. The speed that was reached could not have been maintained for any length of time, as the bearings were very hot and growing hotter. It is now proposed to make extensive changes in the machinery bearings in order to reduce the heating, and it is estimated that these changes will take four or five months to complete.

REQUIN: COMMISSIONED.—The coast-defence ship Requin (formerly 7700 tons, now about 7000), which has been undergoing reconstruction



FRENCH ARMORED CRUISER JEANNE D'ARC, 11,270 TONS.

FRENCH ARMORED CRUISER MONTCALM, 9517 TONS.

for several years, is now completed and has been commissioned. The general character of the work on her is described in PROCEEDINGS No. 97, page 159.

VALMY: NEW LOADING APPARATUS.—M. Guye, *chef d'escadron d'artillerie de marine*, has devised mechanism for the loading of heavy guns, which has been applied to the Valmy's 340-millimeter (13.4-inch) with the result that the time of loading has been much reduced. The interval between unaimed shots was formerly 4 or 5 minutes, but in a recent trial, with the new apparatus, five shots were fired in a little less than four minutes.

INDOMPTABLE: RECONSTRUCTION COMPLETED.—The coast-defence ship Indomptable (formerly 7500 tons, now 500 or 600 tons less), of the same general type as the Requin, is now nearly ready for service after extensive repairs and reconstruction. The alterations effected consisted principally in replacing the old cylindrical boilers by others of the same type and of substituting new model guns of 274.4 millimeters (10.8-inch) gun in closed turrets for the old pieces of 420 millimeters mounted in barbettes. The new turrets are operated by electricity or by hand.

BOURRASQUE: LAUNCH, SEA SPEED, DESCRIPTION.—The Bourrasque was launched at the works of Messrs. A. Normand & Company, Havre, August 31. It belongs to the group of four boats, consisting of the Borée, Rafale, Tramontane and Bourrasque, which boats are a development of the Siroco type. They are of 19 tons less displacement and, with 200 more horsepower, were expected to give 3 or 4 knots more than the contract requirement of the Siroco class, or about 2 knots more than they made on trial. The reduction of displacement is effected by reducing the dimensions and lightening the construction. The length is 147.6 feet; beam, 15.68 feet; drauft aft, 8.0 feet; displacement, 161.9 tons. The coal supply is 18 tons; radius of action, 2000 miles at 10 knots; expected speed, 29 to 30 knots with 4400 I. H. P. Two torpedo tubes and two 3-pounder guns constitute the armament. On a trip from Havre to Cherbourg, where she was to go for her trials, the average speed was 27 knots for 2 hours and 20 minutes.

SIMOUN: TRIAL, DESCRIPTION.—The torpedo boat Simoun, 181 tons, of the Siroco type, has completed her trials, attaining a speed of 27.7 knots. The contract requirement was 26 knots. The following description of the boats of this class is from the London *Engineering* of October 25:

"MM. Augustin Normand and Company, of Havre, have recently delivered to the French Government, at Cherbourg, two protected torpedo boats, the Siroco and Mistral, fitted with the same machinery and boilers as the Cyclone. The trials offer special interest on account of the very heavy weights carried. The dimensions are:

Length on load line	147 ft. 0 in.
Extreme breadths outside armour.....	16 ft. 10 in.

"The nickel steel armor extends to the machinery and boiler compartments, and is distributed as follows:

24-Millimetres (1-in.) bare	Vertical sides from 8 in. below the water-line to the deck. Fore-and-aft bulkheads from 16 in. below the water-line to the deck. Vertical sides of coverings of all parts of machinery and boilers and of the steering engine above deck.
9-Millimetres ($\frac{3}{8}$-in.) bare	All horizontal parts of deck and hatchways.

"The total extra weight resulting from the addition of armor—including the strengthening of the hull amidships, and the addition of a central hollow keel 1 ft. high, extending to about one-half the length of the boats, and intended to stiffen the central part of the structure, and to check rolling—is not less than 24 English tons.

"The hulls are very strong, as was proved by an accident which occurred to an exactly similar protected torpedo boat in a trial outside Lorient. When steaming at about 23 knots, during foggy weather, she ran end-on against a rock rising above water; and although several men were injured by the shock, no material damage, beyond the crushing of about 25 ft. of the fore part, occurred to the boat, which was towed back to harbor.

"The total other weights carried on trial, exclusive of chains, anchors, masts, boats, &c., and comprising only torpedo tubes and compressing pump, artillery and ammunition, provision water for boilers and crew, coals necessary for steaming 1020 nautical miles at 14 knots, crew and effects, provisions, including 5 tons for sundries to complete displacement at sea, amounted to 39.9 English tons in the Siroco and 43.2 tons in the Mistral. Accordingly, the displacement on trial: 177.5 English tons for the Siroco and 178.7 tons for the Mistral, was that of the boats on service.

"It has very wisely been the general custom of the French Admiralty to have the trials of ships made at what was believed to be full load; but lately this rule has been enhanced, as it was ascertained that these full-load trial displacements were often inferior to the real displacement on service.

"If the 24 tons due to armor are added to the above weights, we see that the total weights carried on trial amount to 63.9 and 67.2 tons respectively; that is to say, to about 37 per cent. of the total displacement. This is far from the 35 tons carried on board destroyers of much larger displacement. The weight of coals put on board was determined by an eight hours' preliminary trial.

"The full-speed trials, which took place after the ordinary preliminary runs on the measured mile, were of four hours' duration, one hour of which was to be run at 22 knots, one hour at maximum speed, and the next two hours at 22 knots.

"The one-hour maximum speed was found to be 28.341 knots for the Siroco and 28.102 knots for the Mistral. Only 26 knots were due according to contract. The maximum speed of the Cyclone (unprotected), with a displacement of 141 English tons, was 30.7 knots.

"It is generally admitted that great speed can only be attained by reducing all weights to, and even beyond, their extreme limits. That is, no doubt, true to a great extent. However, from the above results, which may be said to be extraordinary on account of the unusual importance of the deadweight carried, there seems good reason to believe that not only sufficient strength but a very complete armament, and even

some protection, may be given to torpedo-boats and destroyers without an abnormal reduction of speed."

TRAMONTANE: TRIALS.—This torpedo boat of 162 tons, a sister to the Bourrasque, which is fully described on a foregoing page of this number, has completed her trials. On the 3-hour trial at reduced power the speed was 23 knots with 290 revolutions. On the one-hour full power trial the mean speed maintained was 29.8 knots with 339.57 turns.

TROMBE: TRIAL SPEED.—The torpedo boat Trombe, which was seriously injured by running on a rock during her first trials, has been repaired and has completed her trials. The speed maintained during the one-hour full-power trial was 26.6 knots, 0.6 knots in excess of the contract requirement. The Trombe is a sister boat in all respects to the Audacieux, fully described in PROCEEDINGS No. 97, page 157.

TORPEDO BOATS NOS. 253 AND 254: LAUNCH; TRIAL OF NO. 253.—These two boats, which are alike in all respects, are under construction at the yard of Messrs. A. Normand & Company, Havre, where No. 253 was launched on August 16 and No. 254 on September 27. The dimensions of the boats are: Length, 121.4 feet; beam, 13.78 feet; draught aft, 8.6 feet; displacement, 90.2 tons. The designed speed is 24 knots with about 1800 I. H. P. On her one-hour full-power trial in October, No. 253 developed a speed of 25.36 knots with 340.5 revolutions.

TORPEDO BOAT NO. 258: TRIAL SPEED.—This torpedo boat was built at the yard of the Ateliers et Chantiers de la Gironde, Bordeaux. On the one-hour full-power trial the mean speed maintained was 25.56 knots, 1.56 knots in excess of the requirement of the contract. No. 258 is very similar to Nos. 253 and 254 but is 1.6 feet longer.

TORPEDO BOAT NO. 259: LAUNCH.—This torpedo boat is similar in all respects to No. 258, and is building at the yard of the Gironde Company, where it was launched October 2

EXPLOSION OF A BOILER IN TORPEDO BOAT NO. 208.—After going through speed trials with the other boats of the *defence mobile* of the port of Algiers, No. 208 was returning to the anchorage when a tube of one of the boilers suddenly gave way while the boiler was being fired. In turning off the steam, quartermaster Kernec was mortally injured. Two of the firemen were so badly burned that they are likely to die and two others burned in a less severe manner.

SILURE: LAUNCH.—This submarine boat of the submergible type was launched at Cherbourg arsenal October 29, 1901. She is similar in all respects to the Sirène, fully described in PROCEEDINGS No. 98, page 387.

ESPADON: LAUNCH, TRAILS.—The submarine boat Espadon, a sister to the Silure (see preceding paragraph), was launched at the Cherbourg arsenal October 31. About a month later she made her first trial plunge, which continued four hours. The trial is reported to have been satisfactory in all respects. The speed obtained (probably when running on the surface) was 8.7 knots with 380 revolutions. With maximum power the expected speed is 10 knots with 420 revolutions. Later, a second

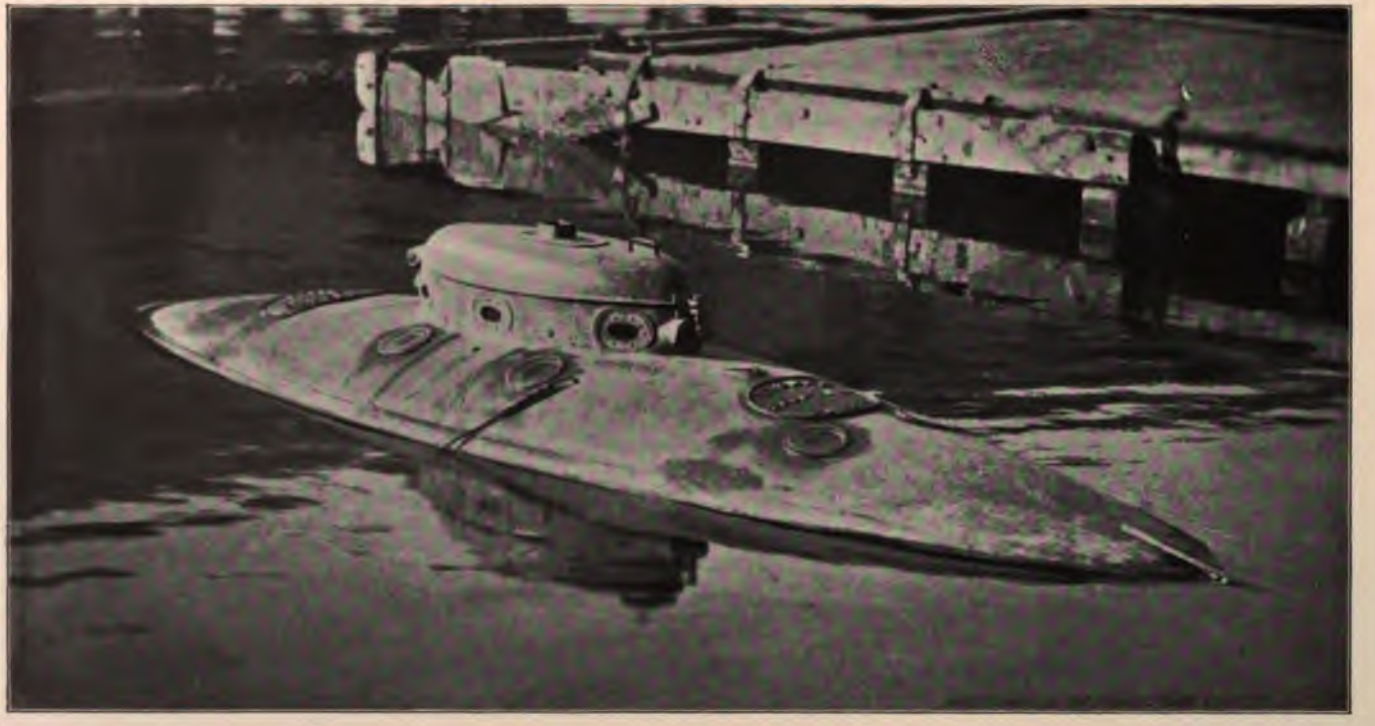
plunge of two hours and a half was made. The time required to submerge to a depth of 9 meters (27.5 feet) was a little less than 8 minutes. As these results were considered very satisfactory the preliminary trials were declared finished.

SIRÈNE: TRIALS.—This submarine boat (fully described in PROCEEDINGS No. 98, page 387) of the submergible type has recently completed her trials and orders have been issued for her to be manned and equipped for service. In an endurance test of 24 hours the speed for three hours at the surface was 7.5 knots; then a plunge for three hours was made (speed not given); then a surface run of 17 hours at a speed of 7.5 knots; and lastly a plunge of one hour during which two torpedoes were launched. The Sirène has a radius of action of 500 miles at 7 knots, which is regarded as ample. The greatest advance made on the design of the Narval, her prototype, is in the time of effecting submersion, which has been reduced from 20 minutes to 9.

TRITON: ACCIDENT.—"A serious accident to the French submarine Triton, at Cherbourg, is reported by The Express. It appears that the vessel plunged too rapidly, struck bottom and sustained considerable damage. Water began to flow in very rapidly, but the engineer ordered the detachable weights to be cast adrift and the boat rose to the surface, though none too soon. The pumps were got to work on the surface and a tug pulled the vessel into the arsenal."—*Army & Navy Journal*, Nov. 23, 1901.

GOUBET No. 2: DESCRIPTION; REJECTION BY FRENCH GOVERNMENT.—This is the second type boat constructed by M. Goubet. The shape of it is very different from that of the other submarines. The cross-section is circular; the general shape being that of a double ogival with bases joined. Above the center rises the conning-tower, and below the center a heavy weight (1.5 tons) acts as a keel, a steadying weight, and safety ballast—as it can be detached if necessary to assist the boat to come to the surface. The hull is of bronze, cast in three pieces, which are joined by outside flanges; and it weighs 5 tons. The shell of the middle section has a thickness of 1 inch; the end sections taper from 1 inch to 0.625 inch at the extremities. The ballast consists of the outside safety weight, or keel, 7 tons of lead ballast, and 2 tons of water ballast. Like all the French boats, the Goubet is fitted with an observation tube extending above water. The armament consists of two torpedo tubes. The propelling power is an electric motor driving a single screw. The electricity is furnished by storage batteries. The speed attained was about 5 knots and the radius of action is about 25 miles. The principal dimensions are: Length, 26.25 feet; diameter, 9.84 feet. The illustration which faces this page is from a recent photograph taken at Toulon. The trials of the Goubet have shown fairly successful results, but she was too slow, and of deficient radius of action. The following note appears in the London *Engineering* of October 18, 1901:

"*Le Yacht* states that M. Goubet has received instructions from the French Ministry of Marine to remove his submarine boat Goubet No. 2 from the arsenal at Toulon, which is tantamount to a rejection of the boat by the French Government. The journal adds that the experiments with the boat have proved that she is habitable, stable, absolutely immo-



FRENCH SUBMARINE BOAT GOUBET, No. 2.

bile at any depth, can float, can be rapidly submerged and brought to the surface again, displays an unequalled facility in her evolutions and in the maintenance of her line of route, and finally an assured security due to her "safety weight" and the ease with which she can rise to the surface in the case of danger. In the experiments of April 19 and 24, 1900, she showed that she could face with safety a high wind and a heavy sea. It is proposed, *Le Yacht* states, that the principle of her construction shall be used in building a submarine vessel for crossing the Channel, by means of which passengers would avoid the terrors of *mal de mer*."

GYMNOTE: DESCRIPTION.—The plans of this boat were submitted in October, 1887, by the Forges et Chantiers de la Mediterranée, and accepted by Admiral Aube, then minister of marine. The designer was M. Zédé, engineer of that company. The boat was built under the supervision of M. Romazotti at the Mourillon dockyard, Toulon, where she was launched on September 15, 1888. The hull is of steel and its shape is similar to that of a Whitehead torpedo. Like the Whitehead, the Gymnote has two horizontal rudders worked by hydrostatic pressure, or by hand, and two vertical rudders worked by the usual appliances. The forward and after ends of the boat are used for water ballast and are filled or emptied by an electrically driven pump. The crew of the Gymnote consists of four or five men, including the commanding officer. The enclosed air would last for several hours for four or five men, but there is no provision for its renewal, as the compressed air reservoir was intended solely for launching the torpedoes and operating the rudders. This boat, like the Goubet and later French boats, was fitted with a tube which projected above the surface of the water and held in its upper end a small mirror about an inch in diameter, set at an angle of 45 degrees to the horizon, and movable about its vertical axis so that the whole horizon could be seen from the inside of the boat, provided of course, that the waves or spray did not destroy the reflecting power of the mirrors. The Gymnote, like the previously-built boats, does not possess good fore-and-aft stability when submerged. When, by outside influence, the bow becomes depressed, the vessel shoots ahead in the direction thus impressed upon it, and some little time elapses before the horizontal rudders act with sufficient force to counteract. When these at last get control and guide her upward, the same performance is repeated, so that she is constantly pitching to every wave in a very unpleasant manner. When moving at a depth below water greater than a few feet, the observation tube is of course useless, and the instability of the boat when at the surface render it of little value. The armament consists of dropping gear for torpedoes. The motive power consists of a single screw driven by an electric motor, which is the invention of Captain Krebs of the balloon service. It consists of 16 poles arranged around a ring armature one meter in diameter. Its weight is 4400 pounds. The propeller is 4-bladed and 4.8 feet in diameter. The motor is direct-coupled to the screw and is designed for a speed of 200 turns per minute. The estimated surface speed was 10 knots for 6 hours, but this has never been reached, about 8 knots being the maximum. The boat is steered, propelled, and lighted by electricity, which is supplied by a battery of 564 alkaline accumulators, invented and manufactured by MM. Commelin, Desmazures, and Bailhache. Each accumulator weighs 38.5 pounds, so that the weight of the whole battery

is 9.66 tons. The total power of the battery is 345 horsepower hours and gives about 60 horsepower with the normal current of 220 amperes at 220 volts. The dimensions of the hull are: Length, 59 feet; greatest diameter, 5.9 feet; displacement when fully submerged, 29.5 tons. The illustration which faces this page is from a recent photograph taken at Toulon.

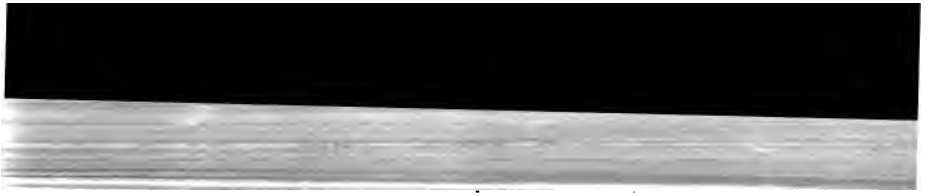
GUSTAVE ZÉDÉ: DESCRIPTION.—The Gymnote was unsatisfactory in many ways. The means of discharging her torpedoes were inadequate to the necessities of the case and she was well-nigh uninhabitable for more than an hour or two. In addition, the speed was insufficient and it was found practically impossible to keep her on an even keel. It was generally conceded that her defects were largely due to her small dimensions; therefore, in 1892, M. Zédé designed a larger vessel which was to be called the Sirène, but was renamed Gustave Zédé upon the death of her designer. She is much larger and of a more slender model than her predecessor, and many of the serious defects of the latter were corrected or minimized. The rising and sinking is effected by means of water ballast, but she also possesses horizontal rudders to correct any tendency to dive or rise abruptly. Two tanks furnish the compressed air for launching the torpedoes as well as for supplying fresh air for breathing; and the foul air is drawn out by an electrically driven pump. The armament consists of a single torpedo tube, and three torpedoes are carried. The motive power is electricity supplied by a Laurent-Ceby storage battery to a 760-horsepower Sautter-Harlé motor, which drives a single screw. It is reported that a speed of 15 knots has been made when running on the surface at light draught, and 8 knots when nearly submerged. Her submerged speed is about 6 knots. The hull is of bronze, designed for strength sufficient to descend with safety to a depth of 60 or 70 feet, and is of the following dimensions: Length, 147.5 feet; diameter, 10.8 feet; displacement when fully submerged, 260 tons. The complement is 9 persons. The trials of the Zédé have been numerous and extensive, but the information which has reached the public is rather indefinite. Various reports of inhabitability, due to foul gases generated by the storage battery, appeared from time to time, but it is believed that this difficulty has been surmounted. The great relative length renders the Zédé very unhandy, and this was one of the causes for the reduced dimensions of the later submarines. The illustration is from a recent photograph taken at Toulon.

BAYARD, GALISSONNIÈRE, TURENNE, EURE, NAUTILE, TORPEDO BOATS LANSQUENET, AND NOS. 26, 38, 42, 53, 91, 113, 118, 119 AND 124: CONDEMNED, LOST, OR STRUCK FROM LIST.—The Bayard (old type battleship of 6000 tons) has been dismantled at Saigon, as no money was allotted in the budget for her maintenance. The Galissonnière and Turenne (practically sister ships to the Bayard) are to be sold; as are the torpedo boats, Lansquenet and Nos. 91 and 113. Torpedo boats Nos. 26, 38, 53, the gunboat Nautile, and the transport Eure have been struck from the list of the fleet. Torpedo boats Nos. 42, 118 and 119 have been condemned. Torpedo boat No. 124 was lost in the Mediterranean on September 17 and lies in such deep water that she cannot be recovered.

GERMANY.

BUDGET AND PROGRAM FOR 1902.—The budget proposals for 1902, which have not yet been passed upon by the Reichstag, call, it is said,

FRENCH SUBMARINE BOAT GUSTAVE ZÉDÉ.



for the construction of seven battleships, two large cruisers, three small cruisers, a continuation of the rebuilding of the ships of the Siegfried type, and a torpedo division; and the cadet ship Gneisenau, which sank near Malaga in December last, is to be replaced by an old cruiser reconstructed for the purpose. It is reported that the German naval authorities have decided to build a torpedo-boat destroyer fitted with Parsons' steam turbines with a view to testing that form of motor.

EDUCATION OF GERMAN OFFICERS.—From an article in the Marine Rundschau we learn that the present regulation in regard to the training of officers was issued in April, 1899. In 1893 regulations were issued which provided that after going through a four weeks' course of training on shore, the cadets joined the training ship until the spring of the following year; the ship, as a rule, cruised in home waters during the summer and passed the winter abroad, in the Mediterranean or West Indies, returning home in the following spring. After passing the examination for, and promotion to, midshipman, they embarked for another full year's course of practical training on one of the cadet and boys' training ships. On these ships, which also went abroad in the winter, theoretical and practical instruction was imparted, terminating with an examination at the end of the voyage. Those midshipmen who passed the examination were sent for a six months' course of purely practical duty on the ships of the evolutionary squadron, and then for a year to the naval academy. After passing the lieutenant's examination (Seeoffizierprüfung), promotion to sub-lieutenant (Unterlieutnant zur See) followed.

The regulations of 1899 changed the program of instruction. After the practical training of one year on board the training ship the theoretical training as naval ensign (Fähnrich zur See—formerly See Kadett), he is again transferred to the naval academy. At the close of the academy course the principal examination for line or executive officer (Seeoffizier) takes place, and the ensign is then sent for half a year to the gunnery and torpedo ships and to the marine infantry for special practical and theoretical courses in gunnery, torpedo, and infantry instruction. Each of these special courses is followed by an examination which has a bearing on the result of the examination for the rank of lieutenant. After completing these special courses, those ensigns who pass the examinations are sent for two years' further practical training on board battleships or large cruisers. The theoretical training ceased with the previously mentioned examination. At the end of the first year promotion follows to lieutenant (Lieutnant zur See, formerly Unterlieutnant zur See), and the seniority is determined.

At the naval academy instruction is given in the following subjects:

(*a*) Navigation, naval tactics, seamanship, gunnery and torpedo instruction, knowledge of ships' machinery, and of ships and their construction, mathematics, physics, English and French.

(*b*) Knowledge of duties, mining, land tactics, fortification, and drawing.

BATTLESHIPS H AND I: DESCRIPTION.—These battleships, as stated in PROCEEDINGS No. 99, page 599, are building at the Germania yard, Kiel, and the works of Herr F. Schichau, Dantzic, respectively, and are of a modified Wittelsbach type. The estimated cost of each ship is 24,860,000

marks ($5,916,680; 1 mark = $0.238). Of this sum, 16,650,000 marks is allotted to the hull, machinery and armor; 7,500,000 marks for guns, mounts, etc.; and 710,000 marks for the torpedo armament. The principal details are:

Armament.—Four new-model 280-millimeter (11.02-inch) guns of the so-called rapid-fire type (firing every 90 seconds according to German semi-official statements); eighteen new-model 170-millimeter (6.68-inch) rapid-firing guns; a large number of small pieces; and several torpedo tubes.

Protection.—Somewhat similar to that of the Wittelsbach class (see PROCEEDINGS No. 97, page 160), but covering a greater proportional area of the side.

Motive power.—Speed the same as that of the Wittelsbach class, 19 knots.

Dimensions.—Displacement, 13,000 tons.

SCHWABEN (EX-G) AND MECKLENBURG (F): LAUNCH.—These two battleships have been launched, the former at the imperial dockyard, Wilhelmshavn, August 19, and the latter at the Vulcan Works, Stettin, November 9. They are similar in all respects. The Schwaben (ex-G) is fully described in PROCEEDINGS No. 97, page 160. As the keel of the Schwaben was laid December 1, 1900, the speed of construction has been excellent.

KAISER BARBAROSSA: TRIALS.—This battleship has completed her trials in a satisfactory manner. The vessels of her class are fully described in PROCEEDINGS No. 98, page 388, and a full page illustration of one of them, the Kaiser Friedrich III, faces page 389. The propelling machinery and boilers are not the same in all the vessels of the class; but, except as regards boilers, the differences are immaterial. The engines of the Barbarossa are triple-expansion and three in number, each having cylinders of 35.4, 57.5, 61.4, and 61.4 inches diameter by 37.4 inches stroke. The boilers are of two kinds: six cylindrical boilers in the after fire-rooms with a total grate area of 505.9 square feet and a heating surface of 16,792 square feet; and six Thorneycroft water-tube boilers in the forward boiler rooms with a total grate area of 413.4 square feet and a total heating surface of 23,929 square feet. Both types of boilers have a working pressure of 192 pounds per square inch. The side screws have each three blades, are each 14.76 feet in diameter, and have a pitch of 19.69 feet. The middle screw has four blades, is 13.78 feet in diameter and has 19.77 feet pitch. The designed number of revolutions is 110 for each screw. The results of the trials are as follows:

	Endurance Trial. June 25-27.	Full Speed Trial. July 5.
Mean draught at beginning, feet	25.66	25.62
Mean draught at end, feet	24.47	25.36
Duration of trial, hours	50.	6.
Revolutions, mean of all screws, per minute	94.	112.8
Coal per I. H. P. per hour, mean engines, lbs.	1.83	——
Indicated horsepower, total	7,360.	13,940.
Air-pressure, water-tube boilers, inches	0.0	2.05
Air-pressure, cylindrical boilers, inch	0.0	0.45
Speed, knots	15.5	18.

ARIADNE: TRIAL.—The following details of the Ariadne's trial appear in the *Journal of the American Society of Naval Engineers*, translated from the *Marine Rundschau:* Duration of trial, 6 hours; mean draught, 15.32 feet; air-pressure in inches of water, 1.7; I. H. P., 8827; revolutions per minute, 168; speed, 22.18 knots. The Ariadne is a protected cruiser of 2645 tons and is a sister ship in all respects to the Amazone, fully described in PROCEEDINGS No. 96, page 703.

WACHT: SUNK IN COLLISION.—On September 14, the small cruiser Wacht (1253 tons, 4000 I. H. P., 20 knots, launched in 1887) collided with the battleship Sachsen. She was taken in tow by the Weissenburg, but a few minutes later she had to be abandoned and shortly afterwards sank. The officers and crew were all saved.

AEGIR: BOILER ACCIDENT.—A boiler tube gave way on the coast defence ship Aegir (3550 tons) recently, injuring four firemen. The boiler was of the Thorneycroft type. No details have been published.

TORPEDO BOAT S_{107}: LAUNCH, DESCRIPTION.—Torpedo boat S_{107}, the last of the torpedo boat division under construction at the Schichau Works, Elbing, was launched on October 21. This is the eighteenth boat of the new large type (they are of the size usually denominated torpedo-boat destroyers) built at the Elbing Works. The armament consists of five 50-millimeter (1.97-inch) rapid firing guns and three training torpedo tubes. The engines are twin-screw, of 5500 to 6000 I. H. P., and are designed to give a speed of 27 to 28 knots. The dimensions are: Length, 200.1 feet; beam, 24.9 feet; draught, 8.53 feet; displacement, 350 tons.

TORPEDO BOAT G_{108}: LAUNCH.—This boat is the first of six (G_{108} to G_{113}) building at the Germania Works, Kiel, where she was launched September 7. The details are practically identical with those of S_{107} given in the preceding paragraph.

TORPEDO BOAT HARBOR.—There is to be constructed at Kiel, near the entrance to the Baltic-North Sea Canal, a harbor of sufficient capacity to afford berths for sixty torpedo boats. Barracks to accommodate the crews of thirty boats (about 1600 men) will be built on shore.

GREAT BRITAIN.

BUDGET AND PROGRAM FOR 1902-03.—The Admiralty officials are reported to be at present (Nov. 20) engaged in preparing the budget and program for next year. It is believed that the estimates for new construction will be less than usual on account of the heavy expenditure for the South African War.

BELLEISLE: PREPARED FOR NEW TRAILS.—See "Guns: Firing," page 830.

AMMUNITION SUPPLY OF NEW BATTLESHIPS.—It is said that the Admiralty has fixed the ammunition supply per gun for the new battleships at 90 rounds of 12-inch, 200 rounds of 6-inch, and 200 to 300 rounds of 12-pounder (3-inch).

Launches: Launch.—The first-class battleship [illegible] was launched at the yard of Messrs. Laird Brothers, [illegible] August 31 last. Her keel was laid August 10, 1892. She [illegible] ship is all respects to the Albemarle, Russell, and Montagu [illegible] described and illustrated in ENGINEERING No. 97, page 267.

Launches: Launch.—The first-class armored cruiser [illegible] was launched at the yard of Messrs. Vickers' [illegible] Barrow, October 28. Her keel was laid August 22, 18[illegible] sister ship to all respects (including boilers) to the Leviathan described in ENGINEERING No. 56, page 602.

Launches: Three Ironclads: Launch.—These first-class [illegible] have all been launched—the Bedford at the Barrow Shipbuilding Company, Govan, August 31; the Exmouth at the government yard, Pembroke, August 29; and the Monmouth at the yard of the London and Glasgow Company, Glasgow, November [illegible] sister ships to all respects to the Kent, fully described in [illegible] No. 56, page 696.

Launches and Engines: Trials.—The trials of these [illegible] were made to give a comparative test of their boilers, are fully [illegible] under the head of "Boilers," page 788.

Scorpion: Ready for Trials.—This protected cruiser [illegible] have been suspended for more than a year, pending [illegible] and alterations, is reported to be again ready for trial.

Sandfly: Trials.—This gunboat of 1075 tons has recently [illegible] her trials with the following results:

Date of Trial.	Duration. Hours.	Steam at engines. lbs.	Vacuum. inches.	Revolutions.	Air-pressure. inches.	I.H.P.	Coal per I.H.P. lbs.
[illegible]	06	203	26.5	124.9	nil.	207	1.5
[illegible]	06	196	26.5	179	nil.	1029	1.5
[illegible]	06	196 ½	26.6	196	02	1427	1.6

The Engines are fully described in ENGINEERING No. [illegible] page [illegible] for Belleville boilers, as were stated, and [illegible] were fitted with boilers of the Babcock & Wilcox type. The [illegible] by the Wallsend Slipway and Engineering Company [illegible] ran [illegible] without incident and were successful in all [illegible] The runs were for the purpose of determining the coal consumption at different speeds and observing the working of the machinery. The third was the full power trial.

Launches: Sinking of the Barbette. Engine Disturbance.—It is reported that one of the barbettes of the Implacable has sunk. The Engineer (London) says that this occurred through moving [illegible] the ship afloat. It appears to be supposed that [illegible] the barbette [illegible] the displacement [illegible] the ship [illegible] the barbette [illegible] the [illegible] of the [illegible] the [illegible] [illegible] the [illegible] [illegible] the [illegible] [illegible] [illegible]

remarkable. There ought to be at least half a dozen keel blocks taking this weight. That the difficulty was remedied by cutting off the base of the cone (*i. e.* the supporting structure) seems no less remarkable. There is no such thing as a cone below the barbette walls; there may be a cylinder or rectangular framing—probably both. If the facts are as stated, there must have been, of course, a great bulge in the ship's bottom; while the transverse frames, longitudinals, and bulkheads must be much bent, buckled, and sprung out of shape. How could all this be repaired in a day? In addition to the troubles mentioned, the Implacable has had some with her machinery. She had three unsuccessful trials, at four-fifths power, on account of hot bearings; and on September 22 she returned to port with her engines broken down after having been out one day.

EURYALUS: ACCIDENT.—While this cruiser was in drydock, on August 24, some of the supporting shores buckled and broke. This led to the giving way of others, and finally the vessel toppled partly over. It appears that the injuries caused are very serious. The bottom is much deformed; many of the boilers are injured and all will probably have to be removed. The sheathing over nearly the whole bottom will have to be renewed as well as some of the plating, and some of the frames will need reforming.

POWERFUL AND TERRIBLE: ADDITIONS TO BATTERY.—These large protected cruisers of 14,200 tons have always been considered to be inadequately armed for ships of their size, especially as they have no armor except that of the 6-inch casemates. It is now proposed to add four casemates, each containing a 6-inch gun. They are to be placed on the gun-deck, one over each of the four midship casemates. This will make all of the casemates double-decked like those of the Drake class.

PROMETHEUS: TRIALS OF SCREWS.—The protected cruiser Prometheus (2135 tons, 7200 I. H. P., 20.5 knots) is to undergo a series of trials with different screws to determine the best design for ships of her class. The first trial will be made with those now fitted and will consist of runs on the measured mile at speeds of 15 to 20 knots. A second trial of a similar kind will be made with screws of greater pitch. She will then be fitted with others of a new type and tried again.

MOORHEN: LAUNCH, TRIALS.—This shallow-draft gunboat of about 180 tons was launched at the works of Messrs. Yarrow and Company, Poplar, August 13. On August 21, she had her official trials. The guaranteed speed of 13 knots was maintained for three hours with open fire-rooms and without using forced draft. During one hour wood fuel alone was used. The speed trial was made while on the way to Sheerness, and for more than two-thirds of the time she steamed against a 25-knot breeze. The Moorhen is a sister ship in all respects to the Teal, which is fully described and illustrated in PROCEEDINGS No. 99, pp. 581 and 603.

ASSISTANCE: COMPLETED.—This vessel is fitted as a repair ship, or floating workshop. She is also fitted with evaporating apparatus sufficient to supply 150 tons of water per day. She was recently completed at the yard of Sir Raylton Dixon and Company, Sunderland, and is to

be attached to the Mediterranean Squadron. The dimensions are: Length, 436 feet; beam, 53 feet; draught, 20 feet; displacement, about 9600 tons. The machinery is of 4200 I. H. P. with forced draft, and 3000 I. H. P. with natural draft. The corresponding speeds are 13 and 12 knots. She will have a 3-pounder gun for signal purposes and will be fitted with apparatus for wireless telegraphy. The complement is 262 officers and men.

TORPEDO-BOAT DESTROYERS: NEW TYPE UNDER CONSIDERATION.—"The British Admiralty has obtained expressions of opinion from leading builders of torpedo-boat destroyers with regard to certain contemplated changes to economize weight and facilitate repairs on vessels of that type. Several destroyers are soon to be built, and it is intended not only to give them increased size and seaworthiness, but also to enlarge their radius of action by providing for larger coal capacity even at the expense of speed. In something like half of the 100 of these boats which have been added to the British fleet within the last three years the speed rate was 30 knots or over, reaching 32 in the Arab, 33 in the Express, 35 8-10 in the ill-fated Cobra and 36 58-100 in the Viper. In the boats now in contemplation the maximum rate will be only 27 knots. There is this difference, however: The destroyers now afloat are capable of maintaining their maximum speed for only three hours with half a load of coal aboard, while the new ones are expected to maintain 27 knots for four hours with a full supply of coal. To obtain these advantages weights must be rigorously economized, and prospective contractors have been asked whether the two sets of engines could not be built closely back to back, instead of separately, so that one central framing or support for the engines might suffice. The court of inquiry to investigate the wrecking of the Cobra, above mentioned, on September 18, whereby upwards of 70 lives were lost, has reported that the vessel simply collapsed because she was structurally weak, that she did not touch ground and that no errors were made in her navigation. The purchase of the Cobra for the government is condemned by the court.—*Army & Navy Journal*, October 26, 1901.

The source which inspired the foregoing is unknown, but it seems probable that the chief point which the Admiralty has in view is increased strength. The reduction of scantling, which has been made to attain very high speed, has proceeded to such lengths that probably few of the 30-knot boats are fit to go to sea except in moderate weather. As nearly all of them were tried at very light draught, compared with the ordinary condition of service, their legend speeds are deceptive. They cannot do anything like 30 knots after commissioning—not because less well handled, nor because the machinery was injured in the full speed trial, but because of greater displacement due to additional weights carried. But even if they could attain 30 knots their weakness makes them almost useless as a fleet adjunct. It is not merely that their shell plates are thin; their frames are too light, and their longitudinals of insufficient depth and stiffness to give the requisite girder strength at sea when the waves leave the middle or ends without much support from the water. As within a year, the Seal, Crane, and Vulture have sagged, or hogged, in not unusual weather, sufficiently to rupture their decks or side plating, while the Cobra broke in two and sank, it seems quite time to consider the question of strengthening future construction.

GREYHOUND: TRIALS.—The torpedo-boat destroyer Greyhound had her first trials on September 7. The details are: steam pressure, 240 pounds; I. H. P., 6373; revolutions, 393; mean speed for three hours, 30.15 knots; mean of several runs over the measured mile, 30.42 knots. On September 24, her second (official?) trials took place with the following results: steam pressure, 240 pounds; I. H. P., 6141; revolutions, 398; mean speed for three hours, 30.337 knots. The Greyhound is fully described in PROCEEDINGS No. 97, page 170.

ROEBUCK: TRIAL.—*Le Yacht* says that the official trials of this torpedo-boat destroyer, a sister in all respects to the Greyhound (see preceding paragraph), took place October 8, and that they were satisfactory; but that owing to the failure of a boiler tube the coal consumption trial was deferred until October 15. The *Rivista Marittima* says that the full power trial of the Roebuck took place on September 27 with the following results: steam pressure, 246 pounds; revolutions, 397; I. H. P., 6573; mean speed for three hours, 30.346 knots; mean of several runs over the measured mile, 30.436 knots.

SYREN: TRIAL.—"The torpedo-boat destroyer Syren, the last of a series of thirteen vessels supplied by Palmer's Shipbuilding Company, carried out her full-power trial at Portsmouth on Tuesday (September 10). The revolutions were 382.9 starboard and 380.2 port, and the total indicated horse-power was 6708. The air pressure was 3.6-in., and the mean speed of the three hours was exactly 30 knots. During the early part of the trial the vessel made six runs over the measured mile in Stokes Bay, when the mean indicated horse-power was 6689, and the speed 29.812 knots."—*Engineer* (London), September 13.

The Syren is described in PROCEEDINGS No. 97, page 170.

COBRA: FOUNDERING OF.—The British torpedo-boat destroyer Cobra foundered at sea September 18, and of the 79 persons on board only 12 were saved. The cause of the catastrophe has been ascribed, with a fair degree of certainty of its correctness, to her breaking in two amidships through the action of the sea, which left her middle body inadequately supported while her ends were lifted by the waves. The Cobra was much the largest of the British destroyers. Her displacement on service was considerably over 400 tons but, owing to changes after completion, her exact displacement, in any assigned condition as to weights carried, is unknown. She was undoubtedly weak. She was built on speculation by Sir W. G. Armstrong, Whitworth and Company, and was commenced in 1899. The Viper, built contemporaneously by Messrs. Hawthorn, Leslie and Company, was also built as a speculation. It was hoped that their high qualities would attract purchasers, and both vessels were acquired by the British Admiralty. When the Admiralty sent its inspector to report upon the Cobra, prior to completing the purchase, he decided that she was structurally weak, and so stated. Suggestions were made as regards the additions which would be considered by the Admiralty to be sufficient; but as the Cobra was a completed vessel, with engines and boilers in place, it was found to be impossible to do very much in the way of adding strength without pulling her to pieces. Nevertheless, after strengthening her as much as possible, the Admiralty accepted her.

A very full history of the Cobra, of her purchase and loss, and of other matters connected with her and with the Viper, is given in the *Engineer* (London) of October 25. It is so exceptionally clear, fair, and logical at all points that the compiler regrets its length forbids its inclusion in these notes.

TORPEDO BOAT NO. 107: TRIALS.—"Torpedo boat No. 107 passed her final official full-speed trial at the mouth of the Thames on Monday (September 23). The mean speed on the measured mile was 25.401, and that for the three hours 25.206, the indicated horse-power being 2899. The notable features of the trial were the smoothness with which the engines worked, the low air pressure in the stokeholds—1.6-in.—and the handiness of the boat in turning. The diameter of the circles at full speed was not more than three lengths under starboard helm, and four lengths under port helm; the boat remaining practically upright. The trial was made with the full sea-going load of 42 tons on board."—*Engineer* (London), September 27.

The first trials, early in September, were not satisfactory, the speed attained being only 24.5 knots. This torpedo boat, which is a sister to No. 108, is described in PROCEEDINGS No. 97, page 170.

TORPEDO BOAT NO. 108: UNSATISFACTORY TRIAL.—Torpedo boat No. 108 attempted her trials on October 18, but was unable to attain the required speed of 25 knots and, after an hour, the trial was discontinued.

NEW SUBMARINE BOATS: LAUNCHES, REMARKS.—"The first of the five British submarine boats launched at Barrow recently (this one was launched October 2) has been undergoing tests preparatory to further trials in deep water. She has been lifted out of the water by means of a floating dock, and deposited on a gridiron, where tests have been made, with a crew of six men on board, of the working of the system of compressed air. The men spent three hours inside the boat before they were restored to the open air. They found no difficulty in breathing, and, it is said, came out of the boat as fresh as possible."—*Engineer*, London, October 18.

A further series of tests of these boats will be undertaken, and for this purpose it has been decided to lengthen the Experimental tank at Horsea Island, Portsmouth. The tank is 1200 yards long, 60 yards wide, and 30 feet deep. The boats will just be able to enter as the entrance is 12 feet wide and the beam of the boats 11.75 feet. As regards crews for the boats, it appears there will be some difficulty. Only volunteers will be ordered to them and the Admiralty's call has not been freely responded to, notwithstanding the extra pay offered. Furthermore, the rigorous medical examination caused the rejection of most of the applicants. The boats are fully described in PROCEEDINGS No. 98, page 396.

HAZARD: TO BE USED AS TENDER TO THE SUBMARINES.—The gunboat Hazard (1070 tons, 3700 I. H. P., and 17 knots) is to be fitted out as tender to the submarines and flagboat of the flotilla.

GREECE.

NEW PROGRAM, CONDITION OF NAVY, ETC.—The following note appears in the *Army & Navy Gazette* of November 2, 1901:

"According to the *Correspondence Politique*, Prince George of Greece

has been expressing very unfavorable opinions upon the Greek Navy, and the manner in which it is administered. It appears to be the prince's purpose to secure control of the naval forces, as he has already done of the military. A certain flutter has accordingly been created, and M. Delyannis has declared in an interview that his opinions were diametrically opposed to those of the prince, and that he would resist any idea of confiding to the latter the control of the navy, especially as the particular situation of the members of the Royal family deprives them of real responsibility. There seems to be some idea of expansion in the Greek Navy. A rumor has spread that a cruiser, a destroyer, and four torpedo boats would be built in England. A despatch from Rome to the *Echo de Paris* asserts that Messrs. Ansaldo, Orlando, Odero, and Pattison (of Naples) have formed themselves into a syndicate in order that they may undertake three armored cruisers of large size, and six torpedo boats for the Hellenic Government. The syndicate thus formed would last but eighteen months, and would only have reference to this particular commission, and the arrangement became necessary because the Greek Government demanded pecuniary advantages which no single firm could allow it. This, at least, is the story published by the *Echo de Paris*."

The remarks concerning the despatch from Rome to the *Echo de Paris* are confirmed by a similar note in the *Moniteur de la Flotte*. In regard to this matter *Le Yacht* says:

"The shipbuilding establishments of Ansaldo, of Sestri Ponente, Odero, of Genoa, Orlando, of Livorno (Leghorn), and Pattison, of Naples, have formed a syndicate to construct in eighteen months, with special privileges of payment, three armored cruisers and six torpedo boats. In addition, it is reported that four torpedo-boat destroyers will be built at Naples."

ITALY.

PERSONNEL: NUMBERS.—"There are at the present time on the active list of the navy: 1 admiral, 7 vice-admirals, 14 rear-admirals, 58 captains, 70 frigate-captains, 75 corvette-captains, 410 lieutenants, 160 sublieutenants, and 110 midshipmen. The engineering staff consists of: 1 inspector-general of naval engineers, 2 inspectors, 7 directors, 9 chief engineers of first class, 11 chief engineers of second class, 17 engineers first class, 15 engineers second class, 8 assistant engineers first class, 12 assistant engineers second class, 1 inspector-general of officer-mechanics, 2 directors, 5 principal chief officer-mechanics first class, 20 principal chief officer-mechanics second class, 70 chief officer-mechanics, 103 chief officer-mechanics second class, 62 chief officer-mechanics third class. The medical department consists of: 1 inspector, 6 directors, 11 chief surgeons first class, 23 chief surgeons second class, 75 surgeons first class, and 63 surgeons second class. The commissariat branch consists of: 1 inspector, 6 directors, 17 chief paymasters first class, 26 chief paymasters second class, 107 paymasters first class, 107 paymasters second class, 28 assistant paymasters. There are 30 captains, 54 lieutenants, and 57 sublieutenants attached to the Corpo Reale Equipaggi, the men of which are enlisted voluntarily and from whose ranks are drawn the quartermasters, seamen-gunners, trained torpedo-men, mechanics, sick-berth attendants, etc.

"The strength of the seamen personnel is 22,496 men, made up of

3969 petty officers, 17,152 seamen, stokers, etc., 677 boys, and 700 specialists. The seamen number 7651, exclusive of 536 quartermasters and trained helmsmen; seamen-gunners and torpedo men, 5006; artificers, 1146; and stokers, 4149. The men are divided into classes, 18,352 being available for service afloat, and 4144 for shore duty."—*Journal of Royal United Service Institution.*

BENEDETTO BRIN: LAUNCH.—This first class battleship was launched at the government yard, Castellamare, November 7, 1901. She is a sister ship in all respects, except boilers, to the Regina Margherita, fully described in PROCEEDINGS No. 99, page 608. The boilers are of the Belleville type, 28 in number.

AMMIRAGLIO DI ST BON: TRIALS.—This first-class battleship had her trials in May and June. The results were as follows:

Character of trial.	Forced draft.	Natural draft.
Date of trial	May 23.	June 26.
Mean draught on trial, feet	24.9	25.0
Corresponding displacement, metric tons	9908.	9950.
Days since last docking	158.	14.
Boilers in use	12.	12.
Duration of trial, hours	1.5	6.
Stream pressure at boilers, pounds	150.	149.7
Steam pressure at engines, pounds	146.	148.
Air-pressure in fire-rooms, inches of water	1.26	0.33
Revolutions, mean	104.	94.4
Indicated horsepower	14,296.	10,407.
Speed, knots	18.3	17.47
Slip of screw, per cent.	16.1	12.5
Coal burned per I. H. P. per hour, pounds	2.18	1.87

The operation of the machinery and boilers is reported to have been satisfactory.—*Rivista Marittima.*

JAPAN.

NEW PROGRAM UNDER CONSIDERATION.—It is rumored that the Japanese government is considering the question of adopting a new building program. The *Jiji Shimpo*, one of the leading newspapers of Tokio, declares that a strong addition to the fleet is necessary. The sole question is that of expense, and if the funds can be obtained there is little doubt that the new program will be a fairly extensive one.

PERSONNEL: NUMBERS OF OFFICERS AND MEN.—There are at present in the Japanese navy 46 admirals, 1828 officers of less rank, 398 cadets, 2543 non-commissioned and petty officers, and 19,149 enlisted men (other than petty officers).

NIITAKA, TSUSHIMA: DESCRIPTION.—These second class protected cruisers are building at Japanese government yards, the former at Yokosuka and the latter at Kuré, though much of the material used in them came from abroad. They will be very similar to the Akitsushima, but the batteries of the new ships will be slightly heavier. The hull is of steel with ram bow and full stern without overhang. The double bottoms will extend throughout the boiler and engine room space and

slightly beyond. There will be two signal masts and three smokepipes. The bridge is forward of the foremast and has a searchlight on each end. A third searchlight will be carried on a raised platform aft. The principal details are:

Armament.—Six 6-inch guns: two in shields on poop and forecastle, and four in sponsons on the main deck, one each side abreast each mast. Ten 12-pounders: six in broadside between the 6-inch guns, one each side on the forecastle under the bridge, and one each side in the cabin, well aft. Four 3-pounders in broadside on the main deck, one each side between the forward 6-inch and forward 12-pounders, and one each side between the center and after 12-pounders. No torpedoes are to be carried.

Protection.—Complete protective deck, 1.5 inches thick on the flat and 3 inches on the slopes amidships. Thick gun shields over 6-inch guns, and possibly some armor or thick plating on the sponsons.

Motive power.—Twin-screw, triple-expansion engines, designed to develop 9400 I. H. P. and give a speed of 20 knots. Coal capacity, 600 tons. Niclausse boilers.

Dimensions.—Length, between perpendiculars, 334.6 feet; beam, 44 feet; mean draught, 16 feet; displacement, 3365 tons.

MIKASA: TRIAL.—The preliminary trials of the battleship Mikasa, 15,200 tons, gave a speed of 18 knots with 15,207 I. H. P. The Mikasa is fully described in PROCEEDINGS No. 96, page 706.

SHIRAKUMO: LAUNCH, DESCRIPTION.—The Shirakumo, torpedo-boat destroyer, built for the Japanese government by Messrs. T. J. Thorneycroft and Company, of Chiswick, was launched October 1. A sister boat, the Asashio, is building at the same works, but is not yet launched. The dimensions of these boats are: Length, between perpendiculars, 216.7 feet; beam, 20.75 feet; mean draught, 6 feet; displacement at this draught, 333 tons. The armament consists of one 12-pounder, five 6-pounders, and two torpedo tubes. The machinery is twin-screw, 4-cylinder, triple-expansion; I. H. P., 7000; estimated speed, 31 knots; bunker capacity, 90 tons. The boilers, four in number, are of the Thorneycroft-Schultz type. The designed speed of 31 knots is to be made at mean load draft of 6 feet, the weight carried being equal to 40 tons. The keel of the Shirakumo was laid on February 28, 1901.

AKATSUKI: LAUNCH.—The torpedo-boat destroyer Akatsuki was launched at the works of Messrs. Yarrow & Company, Poplar, November 13. The Kasumi, a sister boat building at the same works, is nearly ready for launching. The armament is the same as that of the Shirakumo (see preceding paragraph). The dimensions are: Length between perpendiculars, 220.25 feet; beam, 20.5 feet; mean draft, 5.33 feet; displacement at this draft, 325 tons. The estimated horsepower of the machinery is 6000, but this will probably be considerably exceeded. The designed speed is 31 knots; and the coal capacity is 90 tons.

ASAGIRI, HARUSAME, HAYATORI, MURASAME: PRINCIPAL DETAILS.—These torpedo-boat destroyers were ordered in December, 1900, and are under construction at the government yard, Yokosuka. The armament consists of one 12-pounder, five 6-pounders, and two torpedo tubes. The estimated I. H. P. of the machinery is 6000; designed speed, 29

knots; coal capacity, 100 tons. The dimensions are: Length between perpendiculars, 227 feet; beam, 21.5 feet; mean draft, 6 feet; displacement at this draft, 375 tons.

TORPEDO BOATS 57, 58, 59: REMARKS.—These boats, of about 80 tons, are under construction at Kuré dockyard and should be completed before the end of the year.

TORPEDO BOATS 60 AND 61: LAUNCHED.—These boats were built by Herr F. Schichau, of Elbing, and sent out to Japan in sections. They were put together at the Kawasaki Works, Kobe, and launched last June. Their displacement is 83 tons.

TORPEDO BOATS 62, 63, 64, 65, 66: REMARKS.—These boats were built by Messrs. Yarrow and Company and sent out to Japan in sections like Nos. 60 and 61. They are being put together at Sasebo and are probably now about ready for trials.

NEW BOATS OF 88 TONS.—Five boats of 88 tons are to be built in Japan; three at Sasebo and two at Yokosuka. The material has been ordered and work on them is expected to begin about the end of the present year (1901). Their dimensions are to be as follows: Length between perpendiculars, 131.5 feet; beam, 16.25 feet; mean draft, 3.3 feet; displacement, 88 tons. The estimated I. H. P. of the machinery is 1200; speed, 23.5 knots; coal capacity, 14 tons. Armament, two 3-pounders and three torpedo tubes.

AWATAKI, HATO, HIBARI, KARI, KIJI, AND TSUBAME: ORDERED.—In November, 1900, orders were sent to the Kuré dockyard to build six torpedo boats of 150 tons each, to which these names are to be given. A portion of the material for the boats has been received, and it is probable that they are now all under way. The work on the boilers and engines is nearly completed. The dimensions are to be: Length between perpendiculars, 147.6 feet; beam, 16 feet; mean draught, 4.75 feet; displacement, 150 tons. The estimated I. H. P. of the machinery is 4200; corresponding speed, 29 knots; coal capacity, 25 tons. Armament, three 3-pounders and three torpedo tubes.

MEXICO.

NEW GUNBOATS: DESCRIPTION.—These two vessels are building at the yard of the Crescent Shipbuilding Company, Elizabeth, N. J. This company was not the lowest bidder, but its plans were preferred by the Mexican government. The vessels are of steel without sheathing, and have quarters suited to a tropical climate; and, in addition to the regular crew, 200 soldiers can be berthed on board. This permits of their use for transporting small bodies of troops from one port to another without the loss of time which might be required if it were necessary to wait for a regular transport. The head of the Mexican commission which is superintending the building of the boats is Colonel Flaviano Paliza, who has with him a construction engineer and a large force of officers and cadets who will see every part as it is built into the vessels and will be ordered to duty on them when they are completed. The principal details are:

Armament.—Four 4-inch; four 6-pounders; one bow torpedo tube.

Motive power.—The engines are twin-screw, triple-expansion, designed to develop about 2400 I. H. P. and give a speed of 16 knots. The coal supply will be sufficient for 7000 miles at 10 knots.

Dimensions.—Length, 200 feet, beam, 33 feet; draft, 10 feet; displacement at this draft, 1000 tons.

NETHERLANDS.

NEW TORPEDO BOATS FOR EAST INDIES.—Four torpedo boats for service in the Netherlands East Indian marine have been ordered from the Schelde Shipbuilding Company, of Vlissingen. The contract price is 297,000 florins ($119,394), and the contract time for delivery is 13 months.

NICARAGUA.

ARMINIUS: PURCHASED FROM GERMANY.—A despatch from Managua to the *New York Herald* says that the Nicaraguan government has purchased from Germany the old armored gunboat Arminius. This old craft is built of iron and was launched in 1864. She was struck from the list of the German navy some years ago and has since been used for harbor service. The principal details are:

Armament.—Four 21-centimeter (8.27-inch), 10-ton, breech-loading rifles of old type. These may be supplemented by light rapid-firing guns.

Protection.—Armor belt, 4.5 inches thick, iron. Turret armor, 7.25 inches.

Motive power.—Single-screw engines of 1200 I. H. P. Speed when new, 10.5 knots. Coal capacity, about 200 tons.

Dimensions.—Length, 197.3 feet; beam, 36 feet; draft, 13.8 feet; displacement, 1583 tons.

NORWAY.

NAVAL BUDGET FOR 1901-02.—According to *Le Yacht*, the naval budget for 1901-02 amounts to 4,550,000 crowns ($1,219,400; 1 crown = $0.268) in the ordinary expenditure, which is an increase of 65,000 crowns over the budget for 1900-01. The sum of 1,388,000 crowns is for pay; 390,000 for schools; 1,067,000 for armaments; and 1,164,000 for new construction. In addition to this, the extraordinary expenditure is fixed at 2,850,000 crowns.

PORTUGAL.

TEJO: LAUNCH, DESCRIPTION.—This high speed gunboat was launched at the royal naval arsenal, Lisbon, on October 27. The Tejo was built upon plans by M. Croneau, chief constructor. The hull is of nickel steel, and the following are the principal details:

Armament.—One 65-millimeter (2.56-inch) gun on the forecastle; six 3-pounders; three on each beam; one 0.4-inch machine gun on the poop; two torpedo tubes.

Motive power.—Twin-screw, triple-expansion engines of 7000 I. H. P., designed to give a speed of 25 knots. The boilers are of the Sigaudy water-tube type.

Dimensions.—Length over all, 231.6 feet; between perpendiculars, 229.6 feet; beam, extreme, 23.9 feet; beam at the water-line, 22.96 feet: depth, 13.1 feet; draft, 7.2 feet; displacement, 532.7 tons (metric).

RUSSIA.

BUDGET FOR 1901-02.—The Russian budget has not yet appeared in full in any publications which have reached the compiler. It will be given at length in the next number of the PROCEEDINGS. According to the Kronstadtskii Viestnik, the total amount of the budget is 98,318,984 roubles ($50,634,276.76; 1 rouble = $0.515). Of this, the sum of 36,903,856 roubles is for naval construction and armament; 20,485,000 for expenses of ships in commission; 5,359,994 for construction works; 10,891,845 for pay of employès on shore; 4,026,738 for the construction of the port of Emperor Alexander III; 5,200,000 for the improvement of Port Arthur and the port of Vladivostok; 5,740,523 for navy yards and building establishments; 2,402,674 for the superintendence and direction of ports; 1,128,638 for maintaining establishments of instruction and 1,214,063 for hospitals and medical service.

NEW VESSELS ORDERED.—According to the Novosti, five new armored ships with a speed of 20 knots and a displacement in excess of 12,000 tons, are to be built in Russia. The *Mittheilungen aus dem Gebiete des Seewesens* says that four first class armored cruisers are to be built, one each at Libau, Nicolaiev, Windau, and Sevastopol.

KAGUL, OTSHAKOV: CHRISTENING CEREMONY.—The official ceremony of attaching the silver plate to the keels took place recently—that of the Otshakov at Sevastopol on August 28, and of the Kagul at Nicolaiev, September 9.

BORODINO: LAUNCH.—The first class battleship Borodino, 13,576 tons, was launched at the New Admiralty yard, St. Petersburg, September 8, 1901. A very full description of the Borodino is given in PROCEEDINGS No. 97, page 178.

POBIEDA: TRIAL.—On October 14, the battleship Pobieda, 12,674 tons, underwent steam trials, attaining a speed of 18.5 knots. The ship is not completed in her battery and upper works and may not be ready for service until late next spring.

NOVIK: TRIAL.—According to *Le Yacht*, the Novik has had preliminary trials on which the designed speed of 25 knots was exceeded.

RETWISAN: TRIALS.—On her first trial the Retwisan maintained a speed of 18.8 knots for 12 hours. During one hour the speed was over 19 knots. The Retwisan is fully described in PROCEEDINGS No. 97, page 181.

LIEUTENANT BOUROKOFF: NAMED.—The torpedo-boat destroyer of 280 tons, 6500 I. H. P., and 32 knots, taken last year from the Chinese at Taku, has been named Lieutenant Bourokoff and added to the Siberian Fleet.

AKOULA, BYTCHEK: LAUNCH; NAMES OF OTHERS OF CLASS.—The torpedo boats Akoula and Bytchek were launched at the Neva Works, St. Petersburg, on August 24. They are of 150 tons displacement, 4200 I. H. P., and 26 knots speed. There are ten similar boats building at

the Neva Works; the names of the others are: Keta, Maknel, Nalim, Okun, Paltus, Pescar, Plotva, and Sig.

BAKLAN: LAUNCH.—The torpedo-boat destroyer Baklan, 350 tons, was launched at the Neva Works, St. Petersburg, August 12, 1901. The names of the boats of this class are given in PROCEEDINGS No. 97, page 183.

GAGARA, VORON, FILIN, SOVA: TRIALS, DESCRIPTION.—These boats are of the Sokol type and were built at the New Admiralty Works, St. Petersburg. They have all completed their trials recently. The speeds were: Gagara, 27 knots; Voron, 28 knots; Filin, 26.94 knots; Sova, 26.81 knots. The principal details of these boats are said to be:

Armament.—One 12-pounder; three 3-pounders; two torpedo tubes.

Motive power.—Twin-screw, triple-expansion engines of 3800 I. H. P., designed to give a speed of 26.5 knots. The boilers are of the Yarrow type and are eight in number.

Dimensions.—Length, 190 feet; beam, 18.5 feet; maximum draft, 11.5 feet; displacement, 240 tons.

BERKUT, YASTREB, NYROK: TRIALS.—These torpedo-boat destroyers are similar to the Gagara class, described in the preceding paragraph, except that they are reported to be 10 feet longer, to have 6 inches more beam, and 6 inches less draft. They were built at the Ijora Works and the first two have had satisfactory trials. The Nyrok failed on her first trial (October 10), being only able to maintain a speed of 26.18 knots instead of 26.5 knots.

MININ: REFIT.—The old armored cruiser Minin (6168 tons, 5290 I. H. P., and 13 knots), is going to be reconstructed for the third time.

PAMYAT AZOVA: REFIT.—The armored cruiser Pamyat Azova (6096 tons, 11,500 I. H. P., 17.5 knots) will receive next year new boilers of the Belleville type, which are now under construction at the Franco-Russian Works, St. Petersburg. At the same time she will have extensive repairs and alterations, such as the reduction of the height of the smokepipes and reduction of the masts from three to two.—*Le Yacht*, October 5.

ALEXANDER II: REFIT COMPLETED.—The repairs and refit of the old battleship Alexander II have been completed at La Seyne.

SPAIN.

NEW PROGRAM.—It is stated that the ministry of marine has presented to the Cortes a project for the construction of eight battleships of 12,000 tons and four cruisers of 8000 tons, and asked for a credit of 12,000,000 pesetas ($2,316,000) for commencing work upon them. The cruisers are to be built in Spain but the battleships will be ordered abroad. In a despatch from Madrid to the *New York Herald*, dated November 15, it is stated that the Duke of Veragua, minister of marine, has threatened to resign if the credits for the new construction are not granted. By referring to PROCEEDINGS No. 97, page 184, it will be seen that the present program is a revival of that presented by the previous ministry shortly before it went out of office.

SWEDEN.

BUDGET FOR 1902.—The budget for 1902 amounts to 21,445.025 crowns ($5.747,266.70; 1 crown = $0.268), of which 10,461,982 is for ordinary expenses. The sum of 6,996,110 crowns is allotted for expenses of the fleet, of which 3,851,740 crowns are for personnel, 1,685,000 for material, and 1,479,496 for armaments. In the extraordinary budget the sum of 6,693,915 is allotted for continuing the construction of armored ships A, B, and C; for two torpedo boats of the first class, two of the second class, and for commencing work upon another armored vessel. The sum of 1,206,000 crowns is allotted for the armament of these vessels, and 280,000 crowns for continuing the reconstruction of the monitors Thordön and Tirfing.

PERSONNEL: NUMBERS.—The vote in the Swedish parliament provided for an increase of the personnel of the navy, consisting of 50 officers, 53 petty officers, 350 men and 80 boys. This will give a total of 210 officers, 362 petty officers, 2825 men and 400 boys.

TORPEDO-BOAT DESTROYER: ORDERED.—A torpedo-boat destroyer of 31 knots, of the most modern type, fitted to use both coal and liquid fuel, has been ordered of Yarrow, Poplar.

TURKEY.

THE TURKISH PROGRAM.—During the recent war with Greece the Turkish government awakened to the fact that operations were seriously hampered by the condition of the fleet, and that only the inactivity of the Greek squadron, combined with general European diplomatic considerations affecting Crete, prevented the bombardment of, or levy upon, the Turkish Mediterranean ports. Soon after the war the question of improvement of the fleet was discussed, and it was finally concluded that the financial condition of the country and the time required to produce new ships made it desirable to rebuild the old vessels rather than order new ones. The work was taken in hand at once, and at present nearly all the old heavy ships of the Turkish navy are undergoing reconstruction, while new machinery has been installed in the Turkish arsenals; and it was expected that work upon the Abdul Kader, whose frame was rusting on the stocks, would be rapidly pushed. Having no cruisers to repair, it was decided to build some, and orders were placed with Cramp, Armstrong, and Krupp for one cruiser each. A description of the Armstrong cruiser is given in PROCEEDINGS No. 99, page 614. The cruiser building at Philadelphia is of the same design and dimensions; and that to be built by Krupp is very similar.

MESUDIEH: RECONSTRUCTION.—This old battleship of 9140 tons has just been rebuilt at the works of Messrs. G. Ansaldo and Company, Sampierdarena, near Genoa. The boilers and machinery were removed, and the stern was braced and strengthened. Then twin-screw, triple-expansion engines of 11,000 I. H. P. were put in place of the old ones, which operated a single screw. The new boilers, 16 in number, are of the Niclausse type and are installed in four groups of four boilers each. This disposition requires two smokepipes, and they are much higher than the old ones. The expected speed with the new machinery is 15 knots.

The deck, which covered in the old battery and rested on top of the armor, was strengthened. Above it everything (including bulwarks and rail) was cut away, leaving this the main deck (U. S. Naval system of nomenclature). Above the main deck amidships was erected a superstructure which conforms in shape to the armored enclosure below it, except at the extreme ends, which do not curve out. This superstructure is covered in and the upper deck so formed surrounded by a light rail. Above it, at each end, are the usual bridges. The armor on the side of the ship is undisturbed, except that the ports for the battery are slightly enlarged, but the guns are fitted with thick shields which completely close the opening. The old masts have been removed and replaced by a single military mast abaft the smokepipes, carrying a military top and a small search-light platform. The battery consists of: two 9.2-inch guns (see "Guns," page 812), one forward, one aft, in oval balanced turrets of face-hardened armor, 6 inches thick in front and 3 inches on sides and rear; twelve 45-caliber 6-inch Vickers' guns in the central armored battery, six each side, with semi-circular shields 4.5 inches thick, which completely close the ports; fourteen 3-inch, five each side in the central superstructure and one each side forward and one each side aft on the gun-deck; ten 6-pounders, three each side on the superstructure, and one each side on the forward and after bridge decks; two 3-pounders in the military top; two boat guns.

The dimensions of the Mesudieh are: Length, 331.4 feet; beam, 59 feet; mean draft, 26 feet; displacement at this draft, 9120 tons.

ORKANIEH, OSMANIEH, AZIZIEH, MAHMUDIEH, MUKADEM-I-HAÏR, FETH-I-BULEND, AVNI-ILLAH, MUIN-I-ZAFFER: RECONSTRUCTION.—These vessels are all to be repaired at the works of Messrs. G. Ansaldo and Company, Sampierdarena. The four last-named are to be rebuilt, receiving new boilers and engines and a new battery; the others are to have a general refit and be rearmed. The main armament of the larger vessels will consist of one 8-inch gun forward, one 6-inch gun aft, eight 6-inch in the citadel, and eight 3-inch.

UNITED STATES.

PROGRAM FOR 1902-03.—In his annual report the Secretary of the Navy recommends the authorization of the following vessels:

Three first class battleships; two first-class armored cruisers; three gunboats, each of about 1000 tons trial displacement; three gunboats, each of about 200 tons trial displacement, for insular service; three picket boats, each of about 650 tons trial displacement; three steel sailing training ships, each of about 2000 tons displacement; one collier of about 15,000 tons trial displacement; four tugboats.

PERSONNEL: RECOMMENDATIONS OF THE SECRETARY OF THE NAVY.—In his annual report, Secretary Long makes the following recommendations in regard to the personnel:

That the grade of vice-admiral be revived and that the number in the grade be fixed at two (in a later recommendation this is increased to four); that the personnel of the navy be largely increased; that the list of lieutenants be immediately increased to 350, and that of the junior lieutenants and ensigns be increased to 600; an increase in the list of the construction corps; some increase of the list of civil engineers; that no

more professors of mathematics be appointed; that the enlisted force be increased by 3000; that the marines be increased 750; that the title of naval cadet be changed to that of midshipman; that the probationary course of cadets be reduced; that no cadet shall be less than 15 years old nor more than 18 on October first of the year of entrance to the Naval Academy; that officers be not retired in the next higher grade (sections 8 and 9 of the Personnel Act); that all officers advanced numbers be made additional, and not simply those advanced for service in the war with Spain; that the service of retired officers should be counted to advance their rank and pay; and that all service for enlisted men in the army, navy and marine corps should be counted towards the 30 years required for retiring.

NAVAL ESTIMATES FOR 1902-03.—"The naval estimates for the fiscal year 1902-03 amount to $98,910,984.63, which is $20,986,449.03 more than for 1901-02. The increase in the estimates for 1903 over the amount appropriated for 1902 for the same purposes was as follows: Pay of the Navy, $1,297,915; emergency fund, $50,000; Bureau of Navigation, $289,-646.25; Bureau of Ordnance, $1,303,100; Bureau of Equipment, $1,003,200; Bureau of Yards and Docks, $129,325; public works, Bureau of Navigation, $365,530; public works, Bureau of Ordnance, $1,265,700; public works, Bureau of Equipment, $747,800; Bureau of Medicine and Surgery, $55,000; Bureau of Supplies and Accounts, $826,652; Bureau of Construction and Repair, $2,600,000; Bureau of Steam Engineering, $846,100; Naval Academy, $36,590.32; Marine Corps, $384,600.46; increase of Navy, $2,000,000; total, $31, 148,534.03. The amount recommended for increase of the Navy is $23,703,010, or $1,696,990 less than last year. There is an increase of $2,000,000 in armament and a decrease of $3,696,990 for machinery. The largest single increase is in the estimate for work in the Bureau of Yards and Docks. Last year the appropriation for this purpose was $6,775,010, while the estimate for the new year is $20,781,375. The estimate for the Naval Academy improvements is $1,500,000, half the amount of last year's appropriation."—*Army and Navy Journal*, October 19.

It is needless to give the estimates in detail as the appropriation bill usually makes very great changes. The provisions of the bill as it passes Congress will be published in No. 102 of the PROCEEDINGS if the bill has been disposed of in time.

CONDITION OF SHIPS BUILDING.—The following is the condition of vessels building on November 1 in percentages of the total work required to complete them:

BATTLESHIPS.

No.	Name.	Per cent.	No.	Name.	Per cent.
10.	Maine	70	14.	Nebraska	0
11.	Missouri	48	15.	Georgia	2
12.	Ohio	43	16.	New Jersey	2
13.	Virginia	0	17.	Rhode Island	2

ARMORED CRUISERS.

4.	Pennsylvania	6	7.	Colorado	9
5.	West Virginia	2	8.	Maryland	2
6.	California	0	9.	South Dakota	0

PROTECTED CRUISERS.

No.	Name.	Per cent.	No.	Name.	Per cent.
14.	Denver	58	19.	Cleveland	68
15.	Des Moines	57	20.	St. Louis	0
16.	Chattanooga	48	21.	Milwaukee	0
17.	Galveston	45	22.	Charleston	0
18.	Tacoma	20			

MONITORS.

7.	Arkansas	75	9.	Florida	74
8.	Nevada	91	10.	Wyoming	75

TORPEDO-BOAT DESTROYERS.

1.	Bainbridge	99	9.	Macdonough	98
2.	Barry	92	10.	Paul Jones	85
3.	Chauncey	96	11.	Perry	89
4.	Dale	97	12.	Preble	87
5.	Decatur	98	13.	Stewart	63
6.	Hopkins	76	14.	Truxton	78
7.	Hull	75	15.	Whipple	77
8.	Lawrence	99	16.	Worden	76

TORPEDO BOATS.

19.	Stringham	98	30.	O'Brien	98
20.	Goldsborough	97	33.	Thornton	97
27.	Blakely	98	34.	Tingey	70
28.	De Long	98	35.	Wilkes	90
29.	Nicholson	97			

SUBMARINE BOATS.

1.	Plunger	45	6.	Pike	50
3.	Adder	92	7.	Porpoise	80
4.	Grampus	51	8.	Shark	74
5.	Moccasin	85			

A table giving the places where the vessels are building is to be found in PROCEEDINGS No. 98, page 401.

NEW BATTLESHIPS: GENERAL FEATURES.—The *Army and Navy Register*, of November 30, says that the Construction Board has agreed upon the designs of the new battleships, which are to be of about 16,000 tons displacement. The battery will consist of four 12-inch guns in pairs in turrets forward and aft; eight 8-inch guns in pairs in four turrets on the main deck, placed like those of the Indiana and Iowa; twelve 7-inch guns in broadside on the gun deck; twenty 3-inch; and the usual number of machine guns and auxiliary pieces. No torpedo tubes are to be fitted.

NEW ARMORED CRUISERS: GENERAL FEATURES.—These vessels, as recommended by the Board of Construction, will have a displacement of about 14,500 tons; speed, 22 knots; I. H. P., about 25,000; coal supply, about 2000 tons. The entire superstructure will, it is said, be armored. The armor over the broadside battery will be 5 inches; conning tower, 9 inches. The battery will consist of four 10-inch guns in pairs in turrets forward and aft; sixteen 7-inch guns; twenty 3-inch; and the usual smaller pieces. No torpedo tubes will be fitted.

OLONGAPO NAVY YARD: LAND ACQUIRED AND RESERVED.—"The President has signed an executive order creating a naval reservation of a large tract of land just acquired by the Navy Department at Olongapo, on Subig Bay, Luzon. The department will now proceed with all dispatch to construct at this point a navy yard and station of the first order, patterning the plans generally after the Mare Island Navy Yard. As soon as this station is properly equipped a large part of the work now done at the Cavite Navy Yard will be transferred to Olongapo. The latter yard can also undertake repairs of the larger vessels of the Asiatic fleet, which are now expensively repaired at Hong Kong. It is a part of the project to ship the Havana floating dock to Olongapo to supply immediate docking needs, and to remain until permanent stone docks can be constructed."—*Army and Navy Register*, November 16.

SAN JUAN NAVAL STATION: ESTIMATES FOR, ETC.—"Secretary Long will probably submit estimates to Congress in December, amounting to about $3,000,000, for the establishment and equipment of a naval station on the Puntilla at San Juan. The property which will be purchased will cost $500,000. Of course a dry dock will be built in addition to the shops, railroad facilities, etc."—*Army and Navy Register*, September 7.

NEW DRYDOCKS: ALGIERS, GUAM, NEW YORK.—The floating dock for the Algiers naval station has been towed there from Baltimore, where it was launched on October 3. It is 525 feet long over the blocks, has an entrance 100 feet wide between the walls, and will have a maximum lifting power of 18,000 tons. It will be attached to two steel columns on shore by two steel lattice booms, articulated in all directions; and it will therefore be free to rise and fall with the Mississippi River, which has frequent changes of level, as well as to rise and sink while being operated.

The building of a drydock at Guam is under consideration. Owing to the character of the rock in the harbor, the excavation of a large dock would probably be easy and cheap.

Stone dock No. 4 at the New York Yard will probably be commenced early in 1902. The buildings which are on the site of the dock are all old and none are of much value. They are No. 17, used as a saw mill; No. 19, boat shop; No. 44, master shipwright; No. 25, construction and repair rigging loft; No. 26, ordnance storehouse and crematory.

CINCINNATI AND RALEIGH AS TRAINING SHIPS FOR FIREMEN.—The *New York Herald* says that Secretary Long has decided to fit out the Cincinnati and Raleigh as training ships for firemen in the navy. These vessels were selected as they have good power, water-tube boilers, and will be able to accommodate a large engineer's force.

NATIVE FIREMEN IN THE PHILIPPINES.—"The bureau of navigation of the Navy Department has completed arrangements for the maintenance of the insular force in the Navy. The men are rated as native seamen, native firemen, etc., with monthly pay ranging from $8 to $28. Men for the insular force will be assigned only to vessels in service in the Philippines and at Guam. They will not be detailed for duty on board of vessels other than those on the station where the men enlisted, and upon such vessel leaving the station, men belonging to the insular force will be transferred to a vessel remaining on the station, unless they make

request in writing to remain on board the vessel to which attached and to be discharged wherever the vessel may be at expiration of enlistment." —*Army and Navy Register*, September 7.

CLEVELAND: LAUNCH.—The second class protected cruiser Cleveland, 3100 tons, was launched at the Bath Iron Works, September 28, 1901. The vessels of this class are fully described in PROCEEDINGS No. 94, page 376.

ILLINOIS: TRIAL.—The full data of the trial of the Illinois were not available when the notes for No. 99 were prepared. The following particulars are derived from the very full report of the trial by Lieutenant J. M. Pickrell, which appears in the August number of *Journal of the American Society of Naval Engineers:*

	Starboard.		Port.
Steam at boilers, pounds		177.	
Steam at high-pressure cylinder, pounds	175.8		174.1
Vacuum in condensers, inches of mercury	24.6		24.3
Revolutions per minute, main engines	118.4		117.3
Mean speed per hour, knots		17.449	
Slip of propeller in per cent of its own speed, based on mean pitch	13.54		12.7
Air-pressure in fire rooms, inches of water		0.7	
I. H. P., main engines only	6,219.42		6,427.21
I. H. P., main engines, air, circulating and feed pumps		12,757	
I. H. P., main engines and all auxiliaries in operation during trial		12,898.7	

The battleships of this class (Alabama, Wisconsin, Illinois) are fully described in PROCEEDINGS No. 96, pages 709 and 720.

NICHOLSON: LAUNCH, DESCRIPTION.—This torpedo boat, which is one of the last to take the water of those authorized in 1898, was launched at the Crescent Shipyard, Elizabethport, September 23, 1901. A sister boat, the O'Brien, was launched September 24, 1900. The contract for the Nicholson was executed September 26, 1898, and the keel laid December 6 following. The contract price for hull and machinery is $165,000. The complement will be 3 officers and 26 men. The principal details are:

Armament.—Three tubes for 18-inch Whitehead torpedoes and three 3-pounders.

Motive power.—Twin-screw, vertical, triple-expansion engines, designed to develop about 3000 I. H. P. and give a speed of 26 knots. Three Mosher boilers.

Dimensions.—Length on water-line, 174.5 feet; extreme breadth, 17 feet; mean draft, 4.5 feet; displacement at this draft, 174 tons.

BAINBRIDGE, CHAUNCEY: LAUNCH, DESCRIPTION.—These two torpedo-boat destroyers are building at the works of the Neafie and Levy Ship and Engine Building Company, Philadelphia. The Bainbridge was launched on August 27 and the Chauncey on October 26. The contract for their construction was signed October 1, 1898, and the keels were laid August 15, 1899, and December 2, 1899, respectively. The complement is 4 officers and 69 men. The principal details are:

Armament.—Two 3-inch guns; five 6-pounders; two tubes for long 18-inch Whitehead torpedoes.

Motive power.—Twin-screw, vertical, triple-expansion engines, designed to develop 8000 I. H. P. and give a speed of 29 knots. Four Thorneycroft water-tube boilers, having 315 square feet of grate area and 17,768 square feet of heating surface. Normal coal supply, 25 tons; bunker capacity, 139 tons.

Dimensions.—Length on load water-line, 245 feet; extreme breadth, 23.6 feet; mean draft, 6.5 feet; displacement at this draft, 420 tons; maximum draft aft, vessel ready for sea, bunkers full, 7.56 feet; corresponding displacement, 535 tons; tons per inch of immersion at normal draft, 9.4.

WILKES: LAUNCH, DESCRIPTION.—This torpedo boat is building at the works of the Gas Engine and Power Company and Charles L. Seabury Company, Consolidated, at Morris Heights, New York, where she was launched September 28. The contract was executed September 30, 1898; contract price, $146,000. The keel was laid June 3, 1899. The complement is 3 officers and 26 men. The principal details are:

Armament.—Three 3-pounders, three 18-inch tubes for Whitehead torpedoes.

Motive power.—Twin-screw, vertical, triple-expansion engines, designed to develop 3000 I. H. P. and give a speed of 26.5 knots. Seabury boilers. Normal coal supply, 10 tons; bunker capacity, 70 tons.

Dimensions.—Length on load water-line, 175 feet; extreme breadth, 17.64 feet; mean draft, 4.67 feet; displacement at this draft, 165 tons; maximum draft aft with full load, 7.5 feet; tons per inch at normal draft, 5.25.

TORPEDO BOAT DOCKS AT NORFOLK.—"The Navy Department has completed the plans for housing torpedo boats at the Norfolk Navy Yard. The establishment to be provided will be known as torpedo rendezvous No. 2 and the first work to be undertaken is the construction of mooring slips which will be located on St. Helena, situated on the Elizabeth River directly opposite the main part of the Norfolk Yard. The work includes the excavation of slips to a depth of 20 feet at mean low water; the construction of a timber wharf, as shown on plans; the construction of six piers, making seven slips for torpedo vessels, five being about 72 by 292 feet in the clear between rolling fenders, each wide enough for two destroyers or three torpedo boats; one about 80 by 292 feet in the clear and one about 88 by 340 feet; the furnishing of bollards, standard gauge track, eight small gangways, cleats, steam pipe and connections, water pipe and connections, electrical conduit and fittings, metal poles, lamps and wiring for lighting, fixed wooden benches, rolling fenders, in order to make complete slips for housing torpedo vessels. The Navy Department proposes to expend $70,000 on this work."—*Army and Navy Register*, November 9.

PORPOISE, SHARK: LAUNCH.—These two submarine boats, which are building at the Crescent Shipyard, Elizabethport, N. J., have been launched, the former on September 23 and the latter on October 18. The boats of this type are fully described in PROCEEDINGS No. 99, page 622.

VENEZUELA.

NEW PROGRAM.—*Le Yacht* states that the Venezuelan government is purchasing in Germany a cruiser and two torpedo boats.

AMMUNITION.

CANISTER FOR U. S. ARMY.—The Chief of Ordnance, U. S. Army, says: "The results of the test with the combination fuze for 3.2-inch field gun showed that with the fuze cut at zero the minimum effective range of shrapnel is about 200 yards, and the necessity of sometimes covering the ground within this range, particularly in street fighting, coupled with the good dispersion of fragments afforded by canister at close ranges, leads to the conclusion that the shrapnel with the fuze now used cannot be advantageously employed as a substitute for canister." Canister is of great value to vessels operating against infantry, particularly to gunboats in small harbors and narrow rivers. The lack of it in our operations in the Philippines was frequently deplored.

LYDDITE SHELL IN SOUTH AFRICA.—The more we learn of the behavior of lyddite in shells for field guns the less does its value appear. In PROCEEDINGS No. 98 (page 407) there is a note in regard to lyddite shell. Captain Slocum, U. S. Army, in his report to the War Department upon the operations in South Africa, says: "The Lyddite shell has proven one of the distinct disappointments of the war. It has no effect whatever against intrenchments. On exploding, which it almost always does, as far as I could judge, it only makes a small hole about a foot deep and two feet in circumference, and breaks into few fragments. Against the armor of a battleship, for which they are designed mainly, I have no doubt that they would be very effective, and the poisonous gases confined in a closed space would be destructive, but in the open air they are too quickly dissipated to do any injury." As naval officers well know, lyddite shell are *not* effective, as they cannot be driven through armor before exploding.

LYDDITE SHELL: THE OKEHAMPTON ACCIDENT.—While two sergeants and a private were digging out an unexploded lyddite shell on the range at Okehampton, England, it burst, blowing one of the men to pieces and doing nearly as much to his companions. The ultimate cause of the explosion is unknown. Perhaps the shell was struck with a pick or shovel in such a way as to give a sufficient shock to the fuze. We also know that picric acid will and does attack the iron of the shell, forming ferrous picrate, which is remarkably ready to take fire if struck. Furthermore, if the mealed powder in the fuze should be forced into the shell chamber and into contact with the picric acid a very slight amount of moisture might cause the formation of ammonium or potassium picrates, the latter very sensitive. Whatever was the cause, it is plain that unexploded lyddite shell are exceptionally dangerous to handle; and unexploded shells filled with black powder are not the innocuous objects so many consider them.

ARMOR-PIERCING SHELL IN BRITISH NAVY.—A question was asked in the House of Commons on Thursday, the 25th inst., respecting the use

of armor-piercing shell in the Navy. The Secretary to the Admiralty, in reply, said this kind of shell is not filled with high explosives. Shell containing lyddite detonate against thin armor and do little damage inside the ship. No official information had been received showing that the United States Government had adopted a high explosive which can be carried through thick armor, and which does not detonate outside the plate, but explodes by the action of the fuse only. The question whether it was possible or desirable to substitute a high explosive for black powder in armor-piercing shell is now under consideration of the Explosives Committee.—*Engineer* (London), August 2.

LUMINOUS AND SMOKE SHELLS.—Experiments are reported to have been made in Russia with shells containing acetylene gas in addition to a bursting charge. The explosion of the projectile causes the acetylene to take fire, thus producing an illumination of 500 to 800 candle power. A German, Herr R. Fielder, has patented a method of rendering the bursting of shells visible at long distances by including in the smokeless powder charge of the shell a cartridge of amorphous phosphorus which, on combustion, produces a dense, snowy white smoke. The major portion of the charge may be made up of this substance, so that, it is claimed, a dense wall of smoke will be produced in front of the enemy, depriving him of a view of the field.

ARMOR.

UNITED STATES: ROYALTIES FOR ARMOR.—The Acting Attorney-General, Mr. James M. Beck, on August 23, rendered an important decision in regard to the right of the Navy Department to withhold payment upon vouchers in favor of the Carnegie Steel Company and the Bethlehem Steel Company, as royalty for the use of the Harvey process in the manufacture of nickel-steel armor plate. The two claims arose under similar contracts, and are, therefore, settled together. The Attorney-General adhered to his former decision in this matter, and decided that payment could not be made at the present time in view of the pending litigation between the Government and the Harvey Steel Company, with respect to the validity of the letters patent. The comptroller says: "If the contention of the Government be sound and the process used by the Carnegie Company in hardening these plates is not the process covered by the Harvey patents, then it would not be the subject of the agreement of March 24, 1897, and the Carnegie Company was not 'required' to pay royalties thereunder. This is the very question at issue in the pending litigation between the United States and the Harvey Company, behind which latter company the Carnegie Company stands as beneficial plaintiff to the extent of the royalties paid by it, for the Carnegie Company is 'subrogated to the rights of the Harvey Steel Company to the amount of such royalties,' and the Harvey Company 'on the written request and at the expense of the Carnegie Steel Company' must commence and prosecute with due diligence a suit against the United States to recover the royalty due under the said Government license, and must pay over the royalties thus received to the Carnegie Company. It is obvious, therefore, that to pay these royalties is not merely to prejudge the question at issue in the present litigation, but in effect to

concede the entire claim. In my judgment, therefore, you are justified in withholding your approval of this voucher."—*Army & Navy Journal*, August 31.

TRIAL OF 8.8-INCH FACE-HARDENED NICKEL-STEEL PLATE (CAMMELL & Co.).—The test took place at Whale Island, near Portsmouth, England. The plate was 14 feet by 6.8 feet and 8.8 inches thick; and was one of a lot of plates intended for the belt armor of the British battleship Bulwark. It was supported by the usual backing and structure. Three rounds were fired from a 9.2-inch gun with a projectile weighing 380 pounds and a striking velocity of 1900 feet per second. The projectiles were Holtzer, armor-piercing, but were probably made many years ago, as the Messrs. Holtzer state that they have sold no projectiles in England in recent years. They all broke up on impact, the head of one remaining in the plate. The depth of penetration is not reported. There were no cracks and only a slight flaking of the plate about the points of impact.

TRIAL OF 6-INCH FACE-HARDENED NICKEL-STEEL PLATE (ARMSTRONG).—The test took place at Whale Island, August 22. The plate measured 6 by 8 feet by 6 inches, and was made by Sir W. G. Armstrong, Whitworth & Company, at their Openshaw works. It was submitted for test in compliance with the British Admiralty rules concerning firms which desire to be in the list of accepted makers, and was made under the supervision of an Admiralty inspector. The test consisted of four rounds with a striking velocity of 1960 foot-seconds. A fifth round was fired to ascertain the further resisting powers of the plate. At the conclusion of the firing the plate was found to be neither perforated nor cracked. The projectiles used in the test were Holtzer armor-piercing shell weighing 100 pounds, probably many years old. (See remarks on same subject in note of preceding armor test.)

GIEBELER ARMOR.—The following is from a Berlin despatch to the *New York Herald*, dated November 20: "Trials have been completed at the Royal Technical High School of a new mode of steel manufacture, declared by experts as likely to have a revolutionary effect on the world's metal industry and progress.

"It is the invention of a Mecklenburg manufacturer named Giebeler, and consists in imparting to all grades of iron a strength and hardness surpassing nearly double that of the best known Harvey, Krupp or Boehler steel, while cheapening production fifty per cent.

"Projectiles hurled at armor plate, treated by the Giebeler process and 7¾ millimetres thick, made an impression of only 1 millimetre, while Kruppized armor, four millimetres thicker, was completely punctured.

"Resistance experiments showed even more astonishing results. Attempts made by powerful machines proved the steel to possess a strength of 165 kilograms per square millimetre, when the testing apparatus collapsed.

"Among the peculiar features of the process is the increasing strength accruing as the steel grows cold. It is claimed that the process permits the metal to be worked cold or hot. Blades of the new steel chop other steel or iron into splinters, as ordinary steel cuts into wood.

"Next week the representatives of Herr Giebeler go to America with the intention of submitting the process to the great mills there."

TERNI ARMOR: TABLE OF TRIALS OF PLATES OF 67, 76, 90, 110 AND 150 MILLIMETERS.—The following is derived from tables published in the *Rivista di Artiglieria e Genio* for June, 1901.

Character and dimensions of plate in feet.	Date of trial.	Thickness of plate in ins.	No. of shots at velocity given	Caliber of projectile in ins.	Wt. of projectile in pounds.	Striking velocity, f. s.	Velocity of perforation in ordinary steel, f. s.	Ratio of these velocities.	Ratio of caliber to thickn's	Effect on plate.
Patent type, 3.9×4.9	Feb. 26, 1900.	3.54	3	3.0	12.1	2208	1640	1.36	0.84	Plate not perforated; no cracks.
			1	3.0	12.1	2342	1640	1.45	0.84	do.
			1	3.0	12.1	2385	1640	1.47	0.84	do.
			1	3.0	12.1	2415	1640	1.49	0.84	do.
Patent type, 3.6×4.9	Feb. 26, 1900.	3.00	3	3.0	12.1	1972	1437	1.37	1.00	do.
			1	3.0	12.1	2100	1437	1.48	1.00	do.
			1	3.0	12.1	2208	1437	1.54	1.00	do.
			1	3.0	12.1	2297	1437	1.60	1.00	do.
Patent type, 3.9×4.9	Feb. 26, 1900.	2.64	3	3.0	12.1	1837	1312	1.40	1.13	do.
			1	3.0	12.1	1972	1312	1.50	1.13	do.
			1	3.0	12.1	2100	1312	1.60	1.13	do.
Special type, 4.9×7.7	May 23, 1899.	5.9	5	6.0	100	1936	1345	1.44	1.01	do.
			1	6.0	100	2313	1345	1.72	1.01	Plate completely perfor'd, but no cracks.
Special type, 5.25×6.56	Feb. 20, 1900.	4.3	3	4.7	45	1886	1365	1.38	1.10	Plate not perforated; no cracks.
			1	4.7	45	2116	1365	1.55	1.10	do.
			1	4.7	45	2198	1365	1.61	1.10	do.
Special type, 3.9×4.9	March 1, 1900.	3.54	3	3.0	12.1	2208	1640	1.35	0.84	do.
			1	3.0	12.1	2342	1640	1.43	0.84	do.
			1	3.0	12.1	2385	1640	1.45	0.84	do.
			1	3.0	12.1	2398	1640	1.46	0.84	do.
Special type, 3.9×4.9	Feb. 26, 1900.	3.00	3	3.0	12.1	1972	1437	1.37	1.00	do.
			1	3.0	12.1	2100	1437	1.48	1.00	do.
			1	3.0	12.1	2208	1437	1.54	1.00	do.
			1	3.0	12.1	2297	1437	1.60	1.00	Plate completely perfor'd, but no cracks.

All the trials took place at Muggiano.

BOATS.

SUBMARINE BOATS: SPAR TORPEDO FOR DESTROYING THEM.—Not much has recently been heard of the British experiments with spar torpedoes which were designed to destroy submarine boats. One of the English service papers says that the Starfish, which is fitted with the apparatus, has been temporarily laid up and the trials discontinued because there are so many spies about who are endeavoring to find out all about her fittings. If she has fired many torpedoes from her spars she is probably laid up for repairs. Considering the relative strengths of hull a destroyer is more likely to be injured by a torpedo at the end of her spar than a submarine—unless the torpedo is almost against the

submarine's hull. Altogether, it would seem as if this method of attacking submarines is like Timothy Oldmixon's method of killing fleas, with the added danger to the attacker.

WELIN BOAT DAVITS.—Mr. Axel Welin, the inventor of the Welin breech-plug, now so extensively used in this country and abroad, has recently patented a boat davit which has many points of excellence. The davit, at the lower end, terminates in a quadrant of two or three feet radius, carrying a toothed rack on its circumference. At the point of junction of the davit and supporting arms of the arc, and at the same time in the center of the circle of which the arc forms part, there is a pivoted sleeve. The teeth on the davit quadrant work in a horizontal rack on the deck on which the quadrant rolls. The sleeve travels on a horizontal worm shaft, at the inner end of which there is a crank. By turning the crank the sleeve is drawn in or out, the quadrant rolls along the horizontal rack, and the head of the davit is thus lowered, or raised and inclined inboard to place a boat in a cradle on the skid beams or rail. In heavy davits the weight of the davit is taken by a smooth flange on the quadrant that projects beyond the toothed rack, which is then displaced to one side.

STEAM LAUNCHES, VEDETTE BOATS, ETC., IN FOREIGN SERVICES.—In a paper read by Mr. E. C. Carnt before the Glasgow Engineering Congress, 1901, Mr. Carnt says:

"The establishment of boats (steam) of the various classes of ships in the British navy is as follows:

	Pinnaces.		Barges.		Cutters.		
	56 ft.	40 ft.	40 ft.	32 ft.	27 ft.	32 ft.	23 ft.
First class battleships	2	1	1*				
First class cruisers	1	1	1*				
Second class cruisers				1*	1		
Third class cruisers						1	
Torpedo gunboats and sloops							1
Surveying ships						1	

* Only when commissioned as flagships.

"With the construction in this country of warships for foreign navies, the question of equipment of steam boats is brought forward, and we find the Japanese navy adopting two 16-knot 56-foot vedette boats and an open boat, as the steam equipment for the battleship Mikasa, building at Barrow by Messrs. Vickers, Sons, and Maxim.

"The Russian Government requires two 56-foot vedette boats and two 40-foot pinnaces for a vessel building for it in France. These four boats are of steel and very fully equipped.

"The Austrian Government uses a 47-foot wooden turnabout boat with a speed of 11 knots, and are now adopting a specially fast wooden vedette boat 56 feet in length.

"In connection with the vessels recently built by Messrs. Armstrong, Mitchell and Company for the Japanese navy, four 56-foot vedette boats were required.

"Messrs. Armstrong, being always in the front where speed is wanted, asked us to consider the possibility of giving these four boats a speed of 17.5 knots under certain specified conditions.

"These required careful looking into, and the final design became a 56-foot boat with a ram bow, which increased the length about 9 inches.

"The hull was very carefully lightened, consistent with durability, where possible, and the total weight of machinery kept down to 8 tons. The engine was compound, with 8.5 inch by 18 inch cylinders; a water-tube boiler of our own type, with a working pressure of 190 pounds, was fitted.

"On our own private trial the boat gave us an exhibition of speed that we scarcely hoped for, viz., 19.5 knots. The engines developed 320 indicated horsepower at 565 revolutions, without vibration.

"A series of progressive trials were carried out with this first boat, the mean results of which are plotted on the curve attached on the official trials of the four boats, with the load conditions as specified; the mean results were as follow:

	Revolutions.	I. H. P.	Speed.	Date.
No. 1.....	548	297	18,322	May 2, 1900.
No. 2.....	540	297	18.1	May 2, 1900.
No. 3.....	538	302	18.25	June 6, 1900.
No. 4.....	543	292	18.32	June 6, 1900.

"These four boats are, we believe, the fastest vedette boats in the world.

"We are building a similar boat for the Austrian Government; this will shortly be completed, and we anticipate equally satisfactory results."

BOILERS.

TRIALS OF THE MINERVA AND HYACINTH.—These two protected cruisers have recently undergone a series of competitive tests and trials, including a trip from England to Gibraltar and return. They are of the same length, depth, and nominal displacement (5600 tons), but the Hyacinth has one foot more beam. The chief differences are in the boilers and engines. The Minerva is fitted with eight single-ended boilers of the ordinary marine type, designed to furnish steam at 155 pounds, the engines developing 9600 I. H. P. at 140 revolutions. The Hyacinth has eighteen Belleville water-tube boilers, supplying steam at 300 pounds, which is reduced to 250 pounds at the engines and about 150 at the auxiliaries. The engines were designed to develop 10,000 I. H. P. at 180 revolutions.

On her original forced draft trial the Minerva developed 9891 I. H. P. and a speed of 20.34 knots; with natural draft the I. H. P. was 8221 and the speed 19.6 knots. The Hyacinth developed 10,536 I. H. P. on her full power trial, but the speed attained was only 19.4 knots. The low speed was ascribed to bad weather, but the recent trials throw some doubt on this point.

Concerning the recent trials of these vessels, an editorial writer of the London *Engineer*, in the issue of July 26, said:

"The competitive trials of H. M. S. Minerva and Hyacinth terminated on the 20th instant with the arrival at Portsmouth of the first-named cruiser at 9.50 p. m., and the second at 11.25 p. m. No official figures are available, but the statements published are, we have reason to believe, substantially accurate. It would be waste of space to recapitulate the

history of the experiment. Our readers who are not fully informed we must refer to our recent impressions. Last week we illustrated both ships, and gave their leading dimensions. During the run from Plymouth to Gibraltar the engines of both vessels were worked as nearly as possible at 7000 horsepower. Each ship reported herself on arrival, and then continued steaming with the intention of emptying her bunkers, and so ascertaining her endurance at the stated power. The Hyacinth steamed altogether for 103.5 hours, and the Minerva for 150 hours. How much coal the Hyacinth had on board then we do not know. She was driven into Gibraltar, because her boilers leaked so much that the fresh water feed could not be maintained, the evaporators being overpowered. The Minerva lost about two hours repairing machinery. It is stated that at 4 p. m. on Wednesday the 17th, the signal was made, 'Light up and proceed to England.' Three-quarters of an hour later the Hyacinth was steaming at 18 knots. At 5.15 p. m. the Minerva was steaming at full speed. On the run home fogs were encountered three times, by which the ships were delayed. But always the Minerva was the faster boat of the two. A boiler tube burst on board the Hyacinth, and a fireman was so severely scalded that he had to be sent to Haslar Hospital. Both ships are to join at once in the manœuvres. We may incidentally mention here that on the run out Vice Admiral Sir C. E. Domville, Mr. J. Milton, and Mr. Wood were on board the Hyacinth, and Mr. Bain, Mr. List, and Commander M. E. Browning were on board the Minerva. Before the run home they changed ships.

"A consideration of the circumstances of the trial shows that the results were curiously typical. In every way they support the contention of those who advocate the superiority of the Scotch boiler over water-tube generators; but they do more than this. They go to show that the recent high-pressure practice of the Admiralty is in no wise better than the older system. It will be remembered that the Minerva is comparatively an old vessel, built in 1895. She has triple-expansion engines with cylinders 33 in., 49 in., and 74 in., by 3 feet stroke. The boiler pressure is 155 pounds; revolutions, 140; indicated horsepower, 9600. She is at all powers faster than the Hyacinth; precisely why no one knows. Carefully conducted tank experiments proved, we understand, that what may be called the tow-rope resistance of the two cruisers is about the same. No doubt the defect of the Hyacinth lies in the way in which her power is applied, that is to say, in her machinery. The performance of the Minerva was quite uneventful. The only defect manifested was the breakage of the bolt of an eccentric strap, and the consequent bending of one of the straps. The defect was made good with spare gear in two hours. The ship was quite ready to start again on her homeward run the moment her bunkers were filled.

"Leaving the Minerva for a moment, we turn to the Hyacinth. During the first hours of the run out all went well. Then the loss of water began. The evaporators can supply between six and seven tons of distilled water per hour; but this was insufficient to make up the loss. A very curious feature of this loss is that it was found impossible to trace it to its source. The connections and pipes seemed tight, water did not run into the furnaces, nor was it found in the bilges. The loss was not due to priming, of course, because the water would have reappeared in the hot well. The only explanation is that a multitude of very small leaks are equal in effect to one or two large leaks, and that the water

was evaporated and went up the chimneys. A most careful overhaul took place at Gibraltar, and there everything was tested by the hydraulic pump. Not satisfied with this, the ship was taken out of harbor and run for twelve hours to make certain that every joint was tight. This being done, she returned to harbor; fires were drawn and the boilers cooled down.

"We now come to the run home. The statement that within less than two hours from the receipt of the signal to light up, the Minerva was at full speed may appear incredible. It is, however, perfectly true. No wonder will be felt that the Hyacinth with water-tube boilers should get steam quickly, but the performance of the Minerva comes as a surprise. It was not a case of banked fires. While in harbor one boiler out of the eight was under steam to supply electric light, etc. On the day before the return voyage began both ships were moved into the outer harbor, or roadstead; and as there was some wind, the pilot refused to move the Minerva with only one boiler going. Steam was, therefore, raised in two other boilers. As soon as the vessel was moored the fires were entirely drawn, the steam blown down through the condensers, the smoke-box doors opened, and the boilers cooled down for about twenty-four hours. When the order to light up came one boiler was carrying 150 pounds; in two boilers the temperature of the water was at 190 degrees Fahrenheit; in the five remaining boilers it was 90 degrees, that being the temperature of the stokehold—not much in excess of the air on shore. The engines were still warm. Both ships started the moment the engines could give them steerage way. It is no matter of wonder that the Hyacinth should get away quickly, but the fact that the Minerva was so little behind cuts the ground from under the feet of those who maintain that the Scotch boiler is too slow for naval purposes. The draft was never forced; it was assisted by the fans, the pressure not exceeding about half an inch. No doubt the result was secured by boiling the top water, the bottom water remaining comparatively cold. If the hydrokineter had been used several hours would have been lost. This is by no means a solitary instance of what can be done in an emergency. The boilers were in no way injured. On the run home they were properly treated. They were never forced beyond their legitimate power—8400 indicated horsepower—which they can attain with assisted draft.

"As to the Hyacinth, we are told that some anxiety was felt about her Belleville boilers; and this seems to have been justified by the deplorable accident to which we have referred. We have said that the performance of the two ships is opposed to the theory that the high pressures recently adopted by the Admiralty are economical. The Hyacinth has four-cylinder triple-expansion engines, the cylinders being 26 inch, 42 inch, 48 inch and 48 inch, with 30 inch stroke, maximum revolutions 180. It is officially admitted that the engines of the Minerva are more economical, although it is claimed that the boilers of the Hyacinth evaporate about 9 per cent more water per pound of coal. So far as can be said, in the total absence of official figures, it appears that the Minerva burns less coal per mile, other things being equal, than the Hyacinth. The engine friction of the latter, because of the short stroke, high speed, and high pressure—250 pounds—must be greater than that of the Minerva's machinery. The coal burned for all purposes, expressed in terms of indicated horsepower, was as nearly as possible the same for both ships, just under 2 pounds.

"The history of the trial is, as we have said, typical. We have the steady old Scotch boilers, fairly used, and doing their duty perfectly in the one vessel, and in the other we have the Belleville boiler doing as it would seem it always does when pressed. The ship could hardly reach Gibraltar at seven-tenths of her full power, the old trouble, leakage, driving her into port; and be it remembered that the Hyacinth is comparatively a new vessel—1898—that her machinery has been in charge for many weeks of Mr. Gaudin, and that nothing was left undone to make her a success. The Minerva, on the other hand, working up to a higher fraction of her full power, gave no trouble whatever, and beat the Hyacinth in speed.

"A statement appears in the pages of a contemporary, to the effect that when it was found that the Hyacinth was being outpaced by the Minerva, her Belleville boilers were forced up to 10,000 horsepower, yet the ship went no faster through the water: 'The Hyacinth is much more powerfully armed than the Minerva, but her 2000 additional horsepower gives her no appreciable advantage. The trial has demonstrated that the reported speed of the Hyacinth class is fictitious, for, owing to causes which cannot here be inquired into, it is now known that any effort to attain more than 9000 horsepower is labor and fuel wasted. Thus at 7000 indicated horsepower the speed of the Hyacinth was 17.9; at 9400 it was 19 knots; and at 10,000 indicated horsepower it was still 19 knots.' This is only partially true. The particular result named seems to have been due to the state of the weather, and to no other cause. Both ships are affected by rolling and to an extent which deserves investigation. One type of roll appears to have a greater effect in reducing speed than any other; why, no one, so far, seems able to explain.

"The result of the whole trial is precisely agreeable to our forecast. It has added nothing very new to the existing stock of knowledge. The Minerva's machinery behaved just as it has always done. Her Scotch boilers maintained their reputation, and showed once more by how little the Scotch boiler failed a few years ago, and then only as the result of bad design and improper management. The Belleville boilers of the Hyacinth again did just what was to be expected. It will be remembered that we said that the only novelty to be anticipated in their performance would be that they had gone to Gibraltar and come back without a breakdown. This novel experience was not provided. We venture to think that in the light of the results of this trial the admiralty may feel thoroughly justified in proceeding to fit the ships of the navy with properly designed cylindrical boilers, until such time, say five years hence, as they have reason to believe that a really satisfactory water-tube boiler is available."

In the *Engineer* of August 30, the following appears:

"We publish this week the major portion of the text of the parliamentary paper 'Return of the Particulars of the recent Sea-trials of the Minerva and the Hyacinth,' ordered by the House of Commons to be printed on the 7th of August. This report, it will be seen, supplies little information in addition to that which was given in THE ENGINEER, and in its pages only, on July 26th. We have the facts and circumstances of the run out to Gibraltar and home given in detail. They will be or will not be found instructive according to the way in which they are used. If, for example, the Admiralty refuses to draw deductions which we think palpable, then there is no instruction for the Board in the

report. For those who, like ourselves, take it as a plain st
simple facts, it will be at once interesting and useful, in the s
will help us to arrive at some definite conclusions concerning
the Navy, or will confirm the accuracy of the deductions whi
ourselves drawn.

"In the first place, we learn that the principal argument
been used against the retention of the Scotch boiler in sh
has no real foundation. It is not true. It has always been
that steam could not be raised to the working pressure in the
boiler with safety in less than about six hours, whereas it i
importance that steam should be available in less than an
statements made on this subject have been tacitly accepted as t
outside public. We do not except engineers; least of all do
ourselves. In the mercantile marine it is always the practice
steam as slowly as possible, six hours being regarded as a mini
for the operation. The idea is that, working in this way, the
spared injurious stresses by being gradually heated up. In
ships there is no reason for hurry, and the experiment of
steam as fast as possible does not appear to have been tried a
tried, the results have not been made public. There has bee
ignorance on the subject. In any case, the Admiralty have
not tried the experiment, although it was one of the most intere
could be carried out. The water-tube boiler possessed, it wa
the transcendent merit that steam could be got up in it in a
fifth of the time possible with the Scotch boiler. The tria
Minerva and the Hyacinth have settled this question at all e
ever. It will no longer be possible to defend or advocate the
boiler on this ground. We have already said that there was
difference in the time spent in raising steam in the two ships.
now the precise figures before us. At 4.27 p. m. on the 17th o
ships received simultaneously the order to light up and start
mouth as soon as possible. The Hyacinth had two boilers und
and her engines had been warmed up. At 5.20 p. m., that is
fifty-three minutes after receiving the signal, she was steamin
indicated horse-power. The Minerva had one boiler alight ou
at 4.27 p. m. Her engines had been warmed up. We hav
given the temperature of the water in her boilers. At 5.1
that is to say, in four minutes less time than the Hyacinth,
steaming at full speed also, and we learn that her boilers, wh
seen a good deal of service, were not one penny the wo
idea that steam could not be raised quickly in Scotch boilers
ing more than a bogey, a thing to frighten engineers with—
nest in short. No mention is ever made of the circumsta
large engines cannot be warmed up in less than two hours,
period must always be available for getting up steam, no mat
boiler is used, and it is ample for the Scotch boiler, at all e
emergencies. Again, we find that the Hyacinth is far from
economical a ship as the Minerva. It is not necessary to refe
consumption of coal per horse-power per hour. We have the
instructive case of two ships very similar in dimensions, making
voyage at much the same speed. The Hyacinth burned 550 t
Minerva 450 tons. The Hyacinth's engines developed, it is true
1000 horse-power more than those of the Minerva; but for some

unexplained they did not propel the ship any faster. Admiral May, the Controller of the Navy, says, 'The extra horse-power must have been absorbed either in the engines, or on the main shaft bearings, or in the hull. It is possible that the shape of the hull may have had something to say in the matter, but former trials do not bear this out.' The experiments carried out by the Boiler Committee, before the ships went to Gibraltar, gave results showing that while the Belleville boilers, with feed heaters were rather more economical than those of the Minerva, that the engines of the latter required less steam per horsepower per hour. It is well to bear in mind that not the Belleville boilers alone, but the whole engineering policy of the Admiralty is being tried. It has to be decided whether 250 lb. working pressure is really better than 150 lb. This question is scarcely less important than the comparative merits and demerits of different types of boilers. Nothing is easier than being led astray concerning the true nature of the points to be settled. Thus it may be claimed that the Belleville boiler is lighter than the Scotch boiler, but the advantage, such as it is, can be lost if the necessary evaporators required to make up the waste of water are very large, and therefore very heavy. We must take into consideration not so much the weights of different items, as the total weight of all the appliances, coal, and water, required to convey the ship from one port to another port at useful speeds. So far we have failed to find that the Belleville boiler and high-pressure steam give results in any shape or way, and tested by any legitimate method of using figures, which are better than those obtained from the Scotch boiler and the more moderate steam pressures hitherto in vogue; and the tests of the Minerva and Hyacinth only confirm the soundness of the belief that there is not one point or feature in which the new system is not inferior to the old.

"That portion of the report which deals with the condition of the boilers when examined at Portsmouth will be read with interest. It seems that a large number of tubes in the boilers of the Hyacinth were bent. The boiler known as 'No. 10' had fared very badly, the fusible plugs were melted out, nine tubes were bulged, one was burst, with an opening 8in. by 3in. The boilers required, as we stated in our former article, an enormous quantity of water to make up feed. Drinking water, besides the legitimate store of fresh water, was used, and this with evaporators working as hard as they could be driven. The puzzle is what became of the water. The Committee have no explanation to offer. The engineers of the dockyard have found nothing but a number of 'slight' leaks. How these can account for some fifty or sixty tons of water per day is more than anyone seems disposed to say. The latest information available is to the effect that the Admiralty have asked Messrs. Delauney, Belleville and Co., of Paris, the patentees of the Belleville boilers, to send over two representatives to assist in making a survey of the Belleville boilers of the cruiser Hyacinth, and to suggest a remedy for preventing the excessive loss of feed-water. If the water finds its way into the furnaces, its evaporation represents a dead loss of fuel, to say nothing of other evils entailed. The boilers of the Minerva gave no trouble whatever up to the last few hours, and then the draught became bad because of the formation of 'birds' nests,' as the curious rings of solidified coke formed round the tube ends are called. Mr. Yarrow, plagued with these rings years ago in the days of locomotive torpedo-boat boilers, carried out experiments which proved that the formation of

these rings is due to the presence of a small percentage of iron in th coal. It is not often met with in Scotch boilers unless they are presse pretty hard. Very little importance need be attached to this birds' nest ing. Under ordinary circumstances the tubes would have been swep in the usual way, and the nests broken off. At the worst they involve nothing more serious than cooling the boilers enough to let men pas into the back uptake and sweep them off with a wire brush. They are as we have said, due to impurities in the coal; and something of ver much the same kind takes place in water-tube boilers, ridges of cok forming along the tubes, and choking the air spaces. Finally, we ma say that the report contains several tables, mostly of very small value which we have not deemed it necessary to reproduce."

The *Engineer* continues the remarks about the trials in the issue o September 6 as follows:

"We commented last week on the experiments which have been mad with the two cruisers Minerva and Hyacinth; so have several of ou contemporaries. We find it expedient, therefore, to say a few word more about these vessels, and the lessons to be drawn from their per formance. Some confusion of utterance is evident; some lack of appre ciation of the facts, and the bearing and teaching of the facts; a tendenc to exalt the value of those points which tell in favour of the Admiralty and a desire to understate those which tell against its policy. It i necessary under these conditions to set the facts in their true light neither exalting nor depreciating their significance. In the first place it is essential that the word 'if' should be eliminated. 'If' this ha not happened then the result would have been different. 'If' this, that or the other had occurred then right would have been wrong, and wron right, and so on. All this may be useful, and no doubt is useful in it proper place; but the word 'if' is certainly not in its proper place when i is used to obscure issues, or lead up to erroneous deductions. A example of the misuse of the little word is found in the argument tha possibly 'if' the Belleville boilers of the Hyacinth had been built by French firm the workmanship would have been so much better than it i assumed to be, that no leakage would have taken place. Again, it i more than hinted, of course, 'if' an English firm chose they could tur out as good work as any French firm. The implication here is wors than the original suggestion.

"Let us, leaving these things, come down to hard facts as set forth i the official documents. We have two ships, very much alike as far a the hulls, weight of armament, and dimensions are concerned. Th machinery of the Minerva represents probably the best that could b done under the old system; that is to say, with Scotch boilers, triple expansion engines, and 155 lb. pressure. The ship has seen a good dea of service, and her boilers are no longer new. The Hyacinth is, on th other hand, the embodiment of the latest system of naval propulsion— she has short-stroke, high-speed engines, Belleville boilers, and 250 lb pressure. To talk about 'if' is simply disingenuous in connection wit these two cruisers. We have nothing to do with the 'might have been. So far as they go they are the embodiments of two different systems o marine propulsion. These two systems could not possibly be tried mor fairly. We cannot even think of conditions that would be more likely t give an instructive result from experiment. The new system has faile as compared with the old system. We are told, by way of excuse, tha

'if' there had been more experience with the new system the results would have been different. There is no evidence whatever that any amount of experience could have modified the results. With 10,000 indicated horsepower the Hyacinth cannot steam as fast as the Minerva with the same displacement working at 8400 indicated horsepower. It is suggested by the Admiralty that the frictional resistance of the high-speed high-pressure machinery is so much greater than that of the Minerva's low-pressure low-speed—by comparison—machinery that the loss is explained. The hypothesis seems to be in accordance with the facts. The only result of further experience, pushed to its logical conclusion, would be a reversion to the older type of boilers and engines for the Hyacinth. For the last six years we have continually been told the same story—'There are difficulties. If we had more experience, they would be surmounted.' We shall hear the same story, we think, for another decade. The most sanguine believer in the fitness of Belleville boilers, and high-speed engines, and great pressures for cruisers, must have been shocked by the results of the Gibraltar run. It is quite impossible to assert with any expectation of being believed by competent authorities, that the Hyacinth is an improvement on the Minerva. In saying this, it must be very clearly understood that we do not assert that because the Belleville boiler has not been a success, all water-tube boilers must be failures. We do assert that the trial of the Minerva and the Hyacinth tell us nothing, supply no information whatever on this point. Because in this experiment Belleville boilers have been badly beaten, we must go on to argue that no other form of water-tube boiler could have succeeded. About this question—a very important question, no doubt—the runs to and from Gibraltar are absolutely silent. It seems absurd to insist on this limitation, but it is necessary.

"It is not to be disputed that the boilers of the Hyacinth could not be kept supplied with water, and that they suffered from the work they had to do. But, it is argued, the cylindrical boilers were just as bad. The Admiralty ferrules were much worn, and the retarders were wasted somewhat at combustion chamber ends. The brickwork also had suffered. It is not necessary to say more than we said last week about the boilers of the Hyacinth. We have already explained that the bird-nesting, of which so much has been made, is due to the presence of a little iron in the coal. The rings are quite easily removed. A stout wire tube brush driven in from the front end will knock them off. No trouble is experienced with them in fast Atlantic service, nor is there any really to be feared from them in the Navy. That the Admiralty ferrules were wasted is quite likely. They have probably seen a great deal of service. The retarders are neither more nor less than pieces of hoop iron twisted into a spiral and put one into each tube. The cost of each is a few pence. No intelligent engineer who understands boilers can be misled for a single instant as to the true meaning of the reports on the condition of the boilers of the two ships which were published in our last impression. The result of the whole trial is the lesson that the Hyacinth is quite incapable of steaming at much over 6000 indicated horsepower for more than 150 hours, owing to the waste of water, and apparently the bending and bulging and splitting of tubes. The Minerva, on the other hand, could steam at that power until all her coals were gone, and would be ready to run again for a similar period as soon as her bunkers were refilled, no repairs of any kind being needed that could not be carried

out in two or three hours; while, if put to it, she could steam for 120 miles or so at 8700 indicated horsepower. These are plain statements of incontrovertible fact which tell their own story.

"Before the Hyacinth and the Minerva ran to Gibraltar, a series of experiments were carried out by the Committee to test coal consumption. The results are given in a table in the report. This table we have not reproduced because the figures are in various ways involved and confusing. Wise men try one thing at a time, if they can. Either the Committee is not composed of wise men, or they could not. Thus we have the Hyacinth working with closed exhaust and low-pressure jackets, and with open exhaust and 'with jackets,' compared with the Minerva working with open exhaust and jackets. It may, perhaps, be well to explain what the words 'closed exhaust' mean. Nearly all the auxiliary engines in men-of-war are non-compound, and are very wasteful when worked with high-pressure steam. When the main engines are working at 250 lb. a reducing valve lets down the pressure for the auxiliaries to 150 lb., but they are, of course, still wasteful. The closed exhaust is by way of compounding them. They all exhaust into a closed system loaded to about 28 lb. per square inch. The exhaust steam is thence led into the evaporators, the low-pressure receiver of the main engines, or the auxiliary condensers. If a little make-up feed-water is required, then, instead of live steam being put into the evaporators, the auxiliary exhaust is used. Of course, this cannot be done when the full-power of the evaporator is required, for then full pressure must be used. The Minerva is not fitted with closed exhaust. The figures given in the table are so mixed that nothing of moment can be made of them. We do not know whether the consumption of fuel is for all the auxiliary machinery, as well as for the main engines, or not. We cannot tell from the tables whether the water lost is credited as though evaporated in the boilers or not. We are told that the Minerva used .484 lb. of water per horse per hour for jackets and make-up feed, and that of this 0.2 lb. went for feed and 0.284 lb. for the jacket; but this is so small a jacket condensation that there must either be some errors in the figures or else the jacket is nearly useless. No doubt valuable data exist concerning these experiments; but before they can be used to any good purpose they must be re-cast in a form different from that of the table appended to the report."

The following is the statement of the President of the Boiler Committee, giving the events of the two runs:

"Representatives of the Boiler Committee, consisting of the President three members, and the joint secretaries, embarked in H. M. S. Hyacinth and Minerva at Devonport, about 2 p. m. on July 6. The ships sailed at about 3 p. m. on that day, and started working up to 7000 horsepower It was intended that the ships should maintain 7000 horsepower till all the coal, except that in the reserve bunkers (82 tons), was exhausted By 3.45 p. m. the revolutions in the Hyacinth were 152 per minute and the horsepower 6994, and the trial was considered to have started from that time. The Minerva's trial commenced at 4 p. m. The Minerva soon showed that she was the faster ship, and steadily drew away from the Hyacinth. By midnight on the 7th the Minerva was about 4½ miles ahead.

"When passing through the Straits of Gibraltar, early in the morning of the 9th inst., a fog was encountered; the Minerva eased down for 55 minutes, while the Hyacinth had to ease down for two hours. On running out of the fog both ships again worked at 7000 horsepower.

"At 4.30 p. m. on July 10, a bolt of the ahead eccentric strap of the starboard intermediate engine of the Minerva broke, and the starboard engines had to be stopped; the port engines continued running. The strap was found to be damaged, and had to be replaced by the spare one. This work was carried out in about two hours, and at 6.40 the starboard engines started working again, and were worked up to the required power.

"It had been arranged that the water in the reserve tanks of both ships should be used as the only make-up feed-water until it was reduced to 20 tons, in order that the amount of make-up feed used per day might be accurately determined. When the reserve had been reduced to 20 tons, this water was to be kept intact in the tanks ready for use in case of emergency, and all make-up required was to be obtained from the evaporators.

"Special reserve tanks had been fitted in the Hyacinth to hold about 100 tons; this, added to the original reserve tank stowage, gave a total reserve tank stowage of about 140 tons. The total reserve stowage of the Minerva was about 170 tons.

"When the amount was reduced to 35 tons in the Hyacinth, the staff engineer asked to be allowed to start the evaporators on account of the difficulty of getting the water out of the tanks by the special pump fitted for these trials. Two Weir's evaporators working with exhaust steam were started at 5.30 a. m. on the 9th, and the two Normandy's during the afternoon of the 10th.

"At 1.15 a. m. on the 11th of July, the staff engineer of the Hyacinth reported the engines would have to be eased on account of the large loss of water, and the trial was abandoned from 1 a. m. All the evaporators were working at this time, and in addition to the water from the reserve tanks, 25 tons of drinking water had been used for boiler make-up. The Hyacinth returned to Gibraltar at slow speed, arriving there on the evening of the 11th.

"The Minerva continued steaming at 7000 horsepower till 11 p. m. on the 12th, at which time there were still 39 tons of coal in the bunkers, not including the reserve, and 20 tons of water remained in the reserve tanks.

"The average horsepower of the Hyacinth was 7047 for 103.25 hours, with a coal consumption of 1.97 pounds, and the distance run was about 1810 miles at an average speed of 17.6 knots; the Minerva's horsepower was 7007 for 147 hours, with a coal consumption of 2.06 pounds, and the distance run was about 2640 miles, at an average speed of 17.96 knots.

"On the night of the 10th of July, flaming occurred at the after funnel of the Hyacinth, but no flaming is reported from the Minerva. On the examination of the Minerva's boilers after arrival at Gibraltar, it was found that the openings in the Admiralty ferrules were seriously choked, the size of the openings, in some cases, being reduced to about one-third the original.

"The boilers and engines in both ships worked well on the way out, with the exception of the eccentric strap bolt of the Minerva, and a number of leaks which developed in connection with the boilers of the Hyacinth; these latter appeared to become worse after the engines were suddenly eased on entering the fog on the 9th, on which occasion the pressure of the boilers became sufficiently high as to lift the safety valves.

"The loss of water in the Hyacinth was at first attributed to leaky

feed suction pipes, but during the stay at Gibraltar these pipes, the feed and hot-well tanks, and the boilers and boiler blow-outs, were water-pressure tested, and no leaks beyond those already known to exist in the boilers were discovered.

"As no serious leaks could be discovered during the stay at Gibraltar, the leaky joints in the Hyacinth's boilers were remade by the ship's staff; and on Tuesday, the 16th, the ship was taken out for a run at about 7000 horsepower, to test the amount of feed water being lost. This was found to be at the rate of about 55 tons a day, from the records of a six hours' run; after being under way three hours, the engines were eased by order from the deck, and the boiler safety valves allowed to blow off freely, so as to reproduce the circumstances that occurred in the fog on the 9th July. The rate of loss of water was calculated from a steady three-hours' run before easing and a steady three-hours' run after easing, a fresh start being made after easing down, and the water lost during the period the safety valves were allowed to blow being neglected. On return, the Hyacinth anchored in the bay at 4.30 p. m., and all fires were drawn except those in two boilers. The Minerva steamed from the Mole with three boilers alight, and anchored in the bay at about the same time as the Hyacinth anchored; fires were drawn from two boilers.

"Gibraltar Dockyard made a spare eccentric strap for the Minerva, and supplied it to the ship on the morning of the 17th.

"At 3.30 p. m. on the 17th, the Committee embarked; at this time the Hyacinth had two boilers alight for auxiliary purposes, and the Minerva one.

"The boilers of both ships had been thoroughly cleaned during the stay at Gibraltar.

"Before the ships began the homeward run, a communication as follows was handed to the captain of each ship:

"'On the responsibility of the ship's officers, a large quantity of fresh water for boiler make-up has been taken as a precautionary measure in the double bottoms of the Hyacinth, and in the extra reserve tanks of both ships. These latter tanks were fitted specially for the outward trials, and do not form a part of the ship's ordinary fittings. It is to be understood that, except the amount originally allowed to each ship (about 40 tons in the ordinary reserve tanks), this is to be used in cases of emergency only during the homeward run. The evaporators, if they have not been in use before, are to be started as soon as the 40 tons mentioned have been used up, and then the make-up required is to be obtained from the evaporators. If the evaporators are unable to supply the whole of the make-up required, their use at maximum obtainable output is to be maintained, while the remaining water used may be taken from the reserve tanks.'

"In the case of the Minerva, the expenditure of the 40 tons in question was not exceeded, but the Hyacinth had used the 40 tons by 5.15 a. m. on the 20th, though all her evaporators had been working practically all the time.

"At the conclusion of the trial it was reported that 98 tons of water had been used from the reserve tanks of the Hyacinth as make-up feed, in addition to that made by the evaporators.

"The ships were informed that on the signal being made at an unknown time after 4 p. m. by the senior officer at Gibraltar, fires were to be lighted in the boilers not at work, and the ships were to proceed

to Portsmouth as fast as possible. The signal was actually given at 4.27 p. m.

"The engines of both ships had been warmed through by steam from the boilers alight.

"At 4.30 p. m. the Hyacinth's engines were worked slowly in accordance with orders from the deck, steam being supplied by the two boilers which were alight. At 4.52 the after group of boilers were connected up. At 5.05 the forward group and at 5.09 the middle group were connected up, the steam pressure being 200 lb. At 5.20 p. m. the Hyacinth was proceeding at 150 revolutions per minute, the horse-power being nearly 7000.

At 4.30 p. m. the Minerva's engines were worked slowly in accordance with orders from deck. The boilers were connected at the following times:

"2nd, 4.55; 3rd, 5.02; 4th, 5.07; 5th and 6th, 5.10; 7th, 5.12; 8th, 5.15.

"The engines were working up to full power at 5.16 p. m., but had to be eased several times between 5.30 p. m. and 8 p. m., on account of eccentric straps warming up.

"At 5.15 a. m. on the 18th the Hyacinth was about six miles ahead of the Minerva; but, both ships running into a fog, the Minerva ran up to the Hyacinth, and at 9.30 a. m. on the 18th, on emerging from the fog, the ships were nearly level, the Minerva being slightly ahead. Both ships then worked up to the maximum power, but throughout the day the Minerva was stated to have gained one-third of a knot an hour on the Hyacinth. At 7 p. m. another fog was encountered, and the ships went slow through the night, keeping close to each other.

"At 9 a. m. on the 19th they were again level. The fog having cleared, both ships went on again, and during the day the Minerva gradually drew ahead, and was stated to be going a quarter of a knot an hour faster than the Hyacinth. At 7 p. m. the Hyacinth again eased, owing to fog, and went slow till 5 a. m. on the 20th, the Minerva being out of sight ahead.

"The Hyacinth then steamed at over 9000 horsepower till 6.10 p. m. on the 20th, when the fires of No. 10 boiler were drawn on account of a burst tube; one man was slightly injured by the steam and hot coal.

"At 9.50 p. m. the trial in the Hyacinth finished, the ship being then off St. Catherine's, and she arrived at Spithead at 11.30 p. m. The Minerva had passed St. Catherine's at 8.20 p. m., and anchored at Spithead at 9.45 p. m.

"The coal used by the Hyacinth on the way home was stated to be 550 tons; by the Minerva, 451 tons.

"The Hyacinth's evaporators were all in use practically the whole time, but the Minerva used hers but little.

"The maximum power developed by the Minerva was about 8700 horsepower, while that developed by the Hyacinth was nearly 10,000 for at least two hours, during which time the Hyacinth did not perceptibly gain on the Minerva. The Hyacinth's average power when running clear of fog was about 9400, and the Minerva's about 8400 horsepower.

"From the results of the outward run it appears that the radius of action of each of these vessels at 7000 horsepower, as far as the coal is concerned, should be, roughly,

Hyacinth, 2930 miles; Minerva, 3000 miles.

"No difficulty was experienced in either ship at any part of the c ward or homeward runs in keeping up a sufficient supply of coal to fires.

COMPTON DOMVILE, Vice-Admiral,
July 26, 1901. President of Boiler Committee.

COALING SHIP.

COALING BRITISH SHIPS AT SEA.—The recently-introduced arrangem for coaling from a collier at sea did not prove advantageous during evolutions of the combined squadron off the coast of Portugal. T Royal Sovereign only took ten tons per hour in calm and favora weather. On the following day the Empress of India attempted operation while the sea was somewhat disturbed, and was unable to t any fuel from the vessel.—*Army & Navy Gazette.*

COAST DEFENCE.

UNITED STATES: SHIELDS FOR GUNS: PNEUMATIC GUNS.—The pr ceedings of the Board of Ordnance and Fortification at its meeting June 6 have just been approved by the Secretary of War. In many spects this meeting of the board was the most important which h occurred for many years. The thickness and size of shields for rapid-f and coast-defense guns were decided upon; it was unanimously decid that dynamite guns for firing high explosives were unfitted for mode purposes, and the plan for the forthcoming test of mortar batteries Portland, Me., was approved. For 6-pounder and 15-pounder rapi firing guns the board decided that the shields for the protection of t gunners should be one and one-half and two inches thick, respective They are to be of the simplest form practicable to afford the necessa protection. The larger guns of 8, 10 and 12 inches caliber, mounted barbette, are to be provided with shields of a thickness not exceedi 4½ inches. The shields for all guns shall be made of modern fac hardened armor, and shall be of a uniform thickness for the differe types. In order to determine the amount of protection afforded, the be method of securing the shield to the mount, and distributing the effect the impact of the projectiles on the manœuvering of the gun and mou the board has made an allotment of $8000 to make tests with regulati shields mounted on dummies.

The board unanimously decided that dynamite gun batteries are obs lete in view of the recent developments in means of defense. This mea that we are to have no more of these batteries beyond those now in t service. As a matter of fact, the dynamite gun did not use dynami for firing high explosives, but wet gun cotton. The experience of pa years has distinctly shown that batteries of this kind do not meet t requirements of the service. The Navy has had the like experience a has practically abandoned dynamite guns.—*Army & Navy Journal*, Ju 13.

CONSTRUCTION.

NOTE.—Under this head will appear notes on Design, Materials, Sheathing, etc.

JUPITER STEEL.—Considerable attention has recently been paid to experiments with this steel. The following is derived from an article in the *Scientific American:*

"The manufacture is carried on under several patents granted to Andres G. Lundin, and the composition of the steel, the method of the manipulation in the furnace, the special materials and careful work in the molding, have resulted for the first time in the history of the art in the production of a cast steel which, in tests carried out at the navy yard at Boston, has proved to possess qualities of strength and ductility equal to those of forged steel. These excellent results are obtained, moreover, with but little sacrifice of the high economy which distinguishes ordinary cast steel. Perhaps the best evidence of its remarkable qualities is found in the fact that cold chisels and hatchets, cast to the finished shape in this steel, will, after being put on the emery wheel, perform their work and hold their edge with perfect satisfaction; and one of the most striking evidences of what might be called the wrought-steel qualities of this cast-steel product is the fact that at the request of the writer two of these cast chisels were placed end to end and welded with perfectly satisfactory results.

"The stock consists of a large variety of mild steel scrap, such as boiler plate clippings, borings from the gun shops, the scrap from sheet-steel works, old crankshafts, and, indeed, any kind of steel that possesses the necessary composition to make up the furnace charge. The melting is carried on in a large furnace house, the steel for the smaller castings being melted down in crucibles and the metal for the larger castings being melted in 25-ton Siemens' open-hearth furnaces. The preparation of the furnace charge and the introduction of the various ingredients during the furnace treatment is carried out in the manner and proportions indicated by the following example, which will serve to show the proportions, but not, of course, the actual amounts which are treated at any one time in the furnaces, the latter having, as we have said, a capacity of 25 tons.

"A hundred pounds of steel scrap is placed in a crucible in the furnace and melted to a boiling point of about 4000 deg. F. When the boiling point has been reached, from 1.5 to 2.5 pounds of ferrosilicon, containing 12 per cent silicon, is introduced into the molten metal. As soon as the ferrosilicon has melted, 2 to 8 ounces of ferromanganese, containing 80 per cent manganese, is mixed with 3 pounds or less of aluminum, and this mixture is introduced into the molten metal, where it quickly melts. After the resulting composition is thoroughly melted, it is tapped into ladles, carried to the various flasks and poured into the molds.

"In tests recently carried out by the government this steel has shown a tensile strength of 67,300 pounds to the square inch, and an elongation of 25 per cent in 8 inches, while in the bending tests a one-inch-square bar of this cast steel was bent cold through an arc of 93.5 degrees without fracture. As a result of these excellent qualities, Jupiter steel is finding a wonderfully wide range of usefulness in the industrial arts. Thus, the shipwork which is being done for the government and private shipbuilding firms includes the rams for the new United States battleships Rhode Island and New Jersey, each of which castings will weigh 43 tons,

and the stern frame, keel, and sternpost for the same vessel castings include shoes for marine engines, engine thrust bearing and many small parts ordinarily made of forged steel for the construction and fittings of ships, engine beds, engine crank heads, gear wheels, etc. The castings for the battleships Rhod and New Jersey alone will equal in weight over a million pound

MAGNALIUM.—"On several occasions we have remarked the of obtaining any precise information about the properties of t paratively new alloy of aluminium. An article on the subject, has recently been printed in one of the German technical pap which we are able to extract the following particulars. Under th name of 'magnalium,' alloys are now prepared containing be and 25 parts of magnesium per 100 of aluminium. With 10 magnesium the material is said to have the mechanical prop rolled zinc; with 15 parts to resemble cast brass; and with 20 or of magnesium to imitate hard drawn brass and the various grad bronze. Dr. Mach, the inventor, finds that sodium, carbon, and in the original aluminium cause the alloys to be of no value; probably explains why the earlier attempts made by Wöhler to a useful alloy of these two metals were quite unsuccessful. A of tungsten, nickel, and copper, are not harmful to magnalium in so far as they increase the specific gravity of the alloy. T per cent. of antimony has the advantage of raising the meltin from 700 deg. Cent. to a white heat. When less than 10 per magnesium is mixed with the aluminium, the alloy rolls well specially suitable for manufacturing sheet and tube. Large quan magnesium adapt it better for casting purposes.

"The mechanical properties of magnalium have been investig Herr Kaempfer. The alloy turns well, yielding long coherent sh it can be drilled and milled readily, and does not slip or bind. the file it resembles soft brass; it does not clog, and the finest can be used. It takes a high silver-white permanent polish; and be easily blackened. Its hardness is greater than that of pure alu for it cannot be cut with a knife; so that cock-plugs, spindle wheels, and keys can be constructed of it. It shows a fine-grain ture something like steel, instead of the coarse zinc-like appear aluminium. Its specific gravity is 2.52 ± 0.03. The tensile stre magnalium ranges between 20 and 24 kilos. per square mm.—12.7 tons per square inch—whereas that of aluminium is only 7 kil square mm.—4.5 tons per square inch. This is Kaempfer's fig ordinary aluminium; we should prefer to quote 7 tons for cast and 10 to 14 for sheet or bars. Magnalium can be easily coate gold or nickel—? electrolytically—and it can be soldered satisfa The alloy is stated to resist the atmosphere well, not to 'rust,' bear exposure to ammonia and sulphurous acid. It has been ta by Voigtländer und Sohn, the opticians of Brunswick, while Sieme Halske, of Berlin, are reported to be using it in armatures and car construction. At present its cost is high, as the price of magn is still 18 marks per kilo.; but hopes are entertained that a larger u for magnalium may reduce the price of that metal considerably."—*neer* (London).

GUNPOWDER AND EXPLOSIVES.

NITRO-CELLULOSE AND SMOKELESS POWDERS.—A review of Lieutenant Bernadou's new work on "Smokeless Powder, Nitro-cellulose, and Theory of the Cellulose Molecuse" is given at the end of this number of the PROCEEDINGS. This book covers ground hitherto vacant in the literature of ordnance chemistry. There is much that is new and original and the remainder of the work is made up of valuable material, brought together for the first time, which would require much reading to discover and much more to put in such acceptable form. Every one interested in ordnance should study it carefully.

NAVY SMOKELESS POWDER.—The Chief of the Bureau of Ordnance, U. S. Navy, says that the manufacture of smokeless powder for the navy is now in a satisfactory state and no further trouble is to be anticipated with the powder now being made, which is much superior to that being turned out a year ago. The precautions and inspections called for by the recent general order are sufficient to insure the safe storage of nitro-cellulose powders, even if not of the very latest and best type. The explosion at Indian Head was probably caused by the decomposition of some powder made when the process of manufacture was just begun there and of much inferior quality to that now produced. The powder which exploded at Mare Island came from private manufacturers, and while the examining board could not positively demonstrate that the explosion was caused by decomposition, the evidence goes far to support that conclusion. Admiral O'Neil says that the Bureau does not doubt the safety of cordite powder, but believes that it deteriorates with age, is very susceptible to changes of temperature, which affects its efficiency, and is very destructive to the bores of guns. Black powder is still used for ignition charges, as all attempts to use fine grain smokeless for that purpose has resulted in a dangerous rise in pressure.

SMOKELESS POWDER FOR THE ARMY.—The Chief of Ordnance, U. S. Army, says: "The question regarding the use of powders with and without nitroglycerin seems to be, all circumstances considered, in favor of powders of a pure nitrocellulose type, when sufficient chamber capacity in the guns is given to permit of their use. In the matter of erosion, experience has not been sufficient to demonstrate the effect of nitro-cellulose powders. It is learned, however, that a 4-inch and 5-inch gun have been fired about 700 times each with this powder, and yet they do not show any appreciable wear or falling off in velocity.

"As to the stability of smokeless powder, the only test is time, and there is nothing to show that the various mixtures of nitroglycerin and gun-cotton are in any way superior to gun-cotton alone."

COMB-SHAPED POWDER OF MM. DU BUIT AND LUCIANI.—MM. Du Buit and Luciani have recently conducted a series of experiments with smokeless powders made up in shape of a comb, and, from the accounts published, this seems a very favorable form of grain. The experimenters say they are able to vary the action of powder within wide limits by changing the shape and size of the teeth, or fringe, and of the back of the comb, or rod to which the fringe is attached. At first glance the form selected does not seem particularly well adapted to the end sought.

The burning surface does not progressively increase as inflammatic proceeds and our judgment would be that the pressures would rise tc high early and fall too rapidly as the combustion proceeded. Or, kept within bounds as regards the maximum, the mean and ultima pressures would be too low; and that an attempt to sustain the pressu would result in much unburned powder. The proof of the puddin however, is in the eating, and the following results are claimed to ha been achieved. The French 47-millimeter (3-pounder) gun, which, usin a charge of 550 grams of ordinary powder, gave a velocity of 2840 f. with 38,340 pounds pressure, gave the same velocity with 475 grains c the new powder and the pressure was less than 28,400 pounds (2000 kilo per cm. sq.). In a 3-pounder of 60 calibers' length the velocity wit powder of ordinary form is 3018 f. s., and the corresponding pressu 38,340 pounds. The comb powder in this piece gives the same velocit with a pressure of 34,080 pounds. With pressure of 38,340 pounds th velocity was increased to 3372 f.s. In a 2.96-inch field piece, whicl with a charge of 625 grams of ordinary powder, gave a velocity of 164 f. s. with 28,400 pounds pressure, the same weight of new powder gav a velocity of 1771 f. s. and a pressure 25 per cent less. By increasing th charge until the pressure reached 28,400 pounds, the velocity was ir creased to 1968 f. s. In a 5.9-inch gun of 45 calibers the service charg gives a velocity of 2625 f. s. with a pressure of 36,920 pounds (16.5 tor per square inch), while the new powder gave 3018 f. s. with the sam pressure.

These results are remarkable and certainly the means by which the are brought about are worth investigating. As a commentary upon th above, it is interesting to compare the remarks of Mr. Sohlman upc the most desirable shape of powder grain. (See the following note upc the "Development of Smokeless Powder in Sweden.")

THE DEVELOPMENT OF SMOKELESS POWDERS IN SWEDEN.—In a lett to *Engineering*, London, Mr. Ragnar Sohlman, of the Bofors Work Sweden, says:

"The interesting articles in your esteemed journal on the subject American experiences in regard to the different kinds of smokeless pov ders, fully corroborate the similar results arrived at in Sweden.

"In this country nitroglycerin powders have been used by the nav since 1892, and have of late been adapted also for certain heavy gu belonging to the coast defence; whereas the army is using principal a nitrocellulose powder, manufactured at the government factory.

"Up to 1896, smokeless powder was used by the navy only for th light quick-firing guns. That year it was adopted also for the new 1: centimeter (4.7-inch) quick-firing guns.

"The nitroglycerin powder employed for these purposes was ordinar ballistite, containing 50 per cent nitroglycerin and 50 per cent nitrc cellulose of about 12 per cent nitrogen. The heating and erosive effec of this powder is very much the same as that produced by cordite. B using a more suitable shape of the grain—*tubes* instead of *cords*—it wa however, possible to attain a satisfactory velocity without too excessiv pressure, thus avoiding a too great erosive effect on the bore of thes light guns.

"In 1897, during firing experiments carried out at Bofors with 15-centimeter (5.9-inch) quick-firing gun with very small chamber spac

it was found that the heating effect of the powder was too considerable to make it suitable for a gun of this caliber. After a few rounds, a considerable wasting away of the metal around the seat of the projectile was perceptible. After three rounds, using the same metal cartridge case, this was completely worn out at the edge, and could not be used further.

"It was then found necessary to alter the composition of the powder in order to obtain a lower temperature of combustion and, consequently, less corrosive effect.

"This aim was arrived at by lessening the percentage of nitroglycerin to 25 per cent, and using a 'moderant,' which is at the same time a solvent for nitroglycerin and nitrocellulose. In this way it is easy to obtain a composition giving even a lower development of heat and larger volume of gas per unit of weight than a pure nitrocellulose containing a low percentage of nitrogen, such as, for instance, the German Troisdorf powder.

"To prove this, the following results obtained by calorimetric test of the two powders may be cited:

Kind of powder.	Heat units per gram.	Volume of gas of combustion. Permanent.	Aqueous.	Total.	Heat volume of gas per gram.*
Nitroglycerin powder.... (Yielding 11.27 per cent N.*)	922	813	165	978	901.7
Troisdorf powder..... (Yielding 11.98 per cent N.*)	943	750	172	922	870.5

*Nitrogen determined by nitrometer.

"As will be observed, the nitroglycerin powder is capable of performing a slightly greater amount of work per unit of weight, under the same conditions, although the heat produced per gram is somewhat less.

"These theoretical calculations have been upheld by actual experience, the modified nitroglycerin powder having given satisfactory results in various heavy guns, up to such of 25.4 centimeters (10-inch) caliber.

"The experience in Norway, where a similar nitroglycerin powder is used by the army as well as by the navy, for guns of all calibers, and also for the army rifle, seems to be very much the same as in Sweden. Since 1893, when the powder was first introduced into the service, no serious complaints have been made against it.

"In taking cordite as the representative type of powders containing nitroglycerin, as has been done by the author of a paper which appeared on March 8 in your journal, and condemning the whole class on account of the demerits of cordite, a great injustice is certainly done towards the more modern types, which do not share the same faults. For it can hardly be denied that cordite is in several respects an antiquated powder, however great may have been its merits at the time of its first appearance, and even then these merits were disputed.

"Thus, the *cord* shape is not by far comparable to the *tube* or *multi-perforated grain*, when a high ballistic effect with moderate pressure is desired.

"Further, the use of insoluble nitrocellulose, together with a moderant—vaseline—which is not a solvent, either for nitroglycerin or for nitrocellulose, causes serious disadvantages, which are still further aggravated by the excessive percentage of nitroglycerin contained in the powder. By exposing cordite to heat and pressure, it is easy to cause the nitroglycerin to separate from the nitrocellulose in a way very similar

to the squeezing out of water from a wet sponge. It is all but possit that the same phenomena occur, at least partly, in the combustion cordite in a gun. If this be so, the nitroglycerin will burn slight quicker than the nitrocellulose and vaseline, producing a higher tempe ature in the beginning of combustion of the charge than the compositic of the powder and the colorimetric data would indicate.

"A further disadvantage of cordite, which does not exist with tl low percentage nitroglycerin powders containing soluble nitrocellulos is the exudation of nitroglycerin, which takes place at a low temperatur

"The main advantage of the nitroglycerin powders are, in the view your correspondent, their absolute freedom from porosity. A nitr cellulose powder, containing a few per cent of volatile solvent, is a to lose part of this during prolonged storage. The evaporation of tl solvent will cause a tendency of the interior of the grains to contrac As the surface is hard and brittle, the grains will be exposed to intern stresses which may, under unfavorable conditions, cause their breakin up in the bore of the gun, thus producing an excessive pressure.

"In the evaporation of the solvent, a certain porosity is unavoidabl This porosity causes a certain hygroscopicity of the pure nitrocellulos up in the bore of the gun, thus producing an excessive pressure.

"The advantages claimed for the pure nitrocellulose powders are high degree of chemical stability and low temperature of combustio As it seems, however, quite feasible to arrive at the same results, an gain other very important advantages, with a nitroglycerin powder co taining a low percentage of nitroglycerin, such powders will probabl as is also pointed out by Mr. Willcox, prove the most satisfactory f the future."

Mr. Sohlman's first paragraph refers to a long article by Mr. F. Willcox, B. Sc., which was published in *Engineering*. Taking as a guic rather old experiments made by our army ordnance officers, Mr. Willcc reaches the conclusion that the best smokeless powder is likely to l one in which there is a moderate amount of nitroglycerin (say not ov 25 per cent) combined with gun-cotton. That our army ordnance office have not arrived at the same conclusion is apparent from the report the Chief of Ordnance. (See note "Smokeless Powder for the Army on a preceding page.)

CHLORATE MIXTURES: KEEPING QUALITIES.—The keeping qualiti of mixtures in which one of the chlorates is a principal ingredient ha not been considered satisfactory. Perfectly safe when freshly made- more so than many explosives of better general reputation—they usuall deteriorate through time and even moderate irregularities of temper ture until they explode spontaneously or with the very slightest shoc In the annual report of H. B. M. Inspectors of Explosives for 190 published during the past summer, we find that several chlorate com positions have passed the storage stability tests and are now license for use and carriage in Great Britain.

BORLAND SYSTEM FOR THE MANUFACTURE OF NITRO EXPLOSIVES.- Mr. W. D. Borland has recently taken out (in England; date of pater January 19, 1901) a patent for the manufacture of nitro explosives. I the specification the patentee describes, first, a method of regulatin the hardness, density, and explosive qualities of nitro compounds, whethe

in the form of powder or otherwise, and second, a method of removing the solvent which usually clings to a small but injurious extent in the manufactured nitro explosives.

"It has been usual in the manufacture of granular and other nitro-compound explosives to treat them with solutions of materials having a solvent or other regulating action. The above patentee finds that it is possible greatly to enlarge the scope of such treatments by employing emulsions instead of solutions. These emulsions consist of methylated spirits and small quantities of some such material as acetone, camphor, liquid paraffin and benzoline, or refined naptha. The liquid paraffin is very slightly soluble in all these materials, except benzoline, but it forms with them a good emulsion, and may in the emulsion be introduced into the nitrocellulose compound without having, as is usual, first to subject the compound to the action of solvents, and then to the process of introducing the oily matter.

"The effect, upon the ballistic qualities of the powder, of introducing the oily material in the form of emulsion, is very different to that resulting from its introduction in solution. By this emulsion method a very hard grain may be obtained, which at the same time is porous. The proportion of the following example of an emulsion used per ton of powder would be about 120 gallons:

1000 parts by volume of methylated spirits.
10 parts by volume of acetone.
5 parts by weight of camphor.
5 parts by weight of liquid paraffin.
30 parts by volume of benzoline or refined naptha, specific gravity .700 to .776.

"The above emulsion is suitable for treating a granular nitro-compound, consisting mainly or wholly nitrocellulose.

"As regards the removal of the small quantities of volatile solvents, which are retained in the nitrocellulose explosive, the presence of such a non-volatile body as liquid paraffin would rather increase the liability to retention of the remaining volatile portions; but the patentee overcomes this difficulty, both as regards compounds treated with this emul sion, and with solution, by treating the nitro-compounds with warm air. The temperature of the air should be about 150 degs. Fahr., and should be charged with watery vapor. One method of so charging the air is to admit a small jet of low pressure steam into the inlet opening of a fan for supplying the warm air. Air so charged speedily removes the remaining volatile constituent parts, and a further benefit is reaped inasmuch as the generation of electricity, which is frequently observed in dealing with hot dry nitrocellulose explosives, is practically obviated."—*Arms & Explosives.*

GUNS.

UNITED STATES NAVAL GUNS: EXTRACTS FROM REPORT OF CHIEF OF BUREAU OF ORDNANCE.—The following extracts from a *résumé* of the report of the Chief of Bureau of Ordnance are derived from the *Army and Navy Journal* of October 26. The complete report has not yet (November 10) been published.

"There were no important developments in armor or naval ordnance

during the year, but improvements were made in details. Hereafter i constructing guns of and above 6 inches caliber provision will be mad for an inner and outer barrel, instead of a solid forging as heretofor The bureau has taken steps to procure greater efficiency in guns b introducing heavier projectiles and by seeking powder of higher ba listic power. The bureau knows of no guns afloat or soon likely to b put afloat equal in energy to those being manufactured for United State vessels now building. Our equipment is fully up to the highest standar maintained abroad for vessels of corresponding class and age.

"Work at the naval gun factory has been carried on continuousl the principal machines being kept running two, and often three, shifts eight hours in twenty-four.

"The number of guns completed during the year was 143, and 2 were partly completed. There were also on hand at the end of the yea forgings, on which no work had been performed, for a large number guns of all the calibers.

"The 6-pounder automatic guns do not meet with universal favor i the service. The automatic feature need not be used, however, unle desired."

UNITED STATES SEACOAST ARTILLERY: NEW 16-INCH GUN.—Th principal details are as follows: Charge, 576 pounds of the present arm smokeless powder; or 1176 pounds brown powder; chamber pressur 37,000 to 38,000 pounds; projectile, 2370 pounds; muzzle velocity, 23 f. s.; muzzle energy, 88,000 f. t.; length of gun, 49.25 feet; diameter breech, 5.0 feet; diameter of muzzle, 2.33 feet; caliber, 16 inches; weigh about 300,000 pounds; shrinking between tube and jacket, .06 inc weight of tube, 102,000 pounds; weight of jacket, 76,000; at 40° elevatio the estimated range is 20.98 miles; maximum elevation of point of traje tory, 30,516 feet.

GUNS FOR SPANISH NAVY.—It is reported that the Spanish Minister Marine has ordered from Messrs. Vickers, Sons & Maxim a number 177-millimeter (6.97-inch) rapid-firing guns. The weight of projectile stated at 96 kilograms (211.6 pounds—which is excessive for this calibe and that the required speed is eight shots per minute. It is quite like that the gun is the 7.5-inch.

BRITISH 12-INCH, 40-CALIBER WIREWOUND GUN (VICKERS-MAXIM).- This gun, built by Messrs. Vickers, Sons & Maxim, is intended for th new battleships. Its section is shown in Fig. 1. The dotted lines abo the gun show the pressure curves with nitrocellulose powder and wi cordite. The longitudinal shading in this as in the other figures sho the wire. The total length of the gun is 496.5 inches; length of powd chamber, 87.2 inches; diameter of powder chamber, 17.5 inches; leng of bore, 480 inches; travel of shot, 33 feet; maximum pressure in gu 17 tons; weight of projectile, 850 pounds; cordite charge, 207 pound corresponding velocity, 2500 f. s. when gun is new; nitrocellulose charg 321 pounds; corresponding velocity, 2674 f. s. for a very large numb of rounds, the loss from erosion with nitrocellulose powder being ve slight compared with that from erosion caused by cordite; energy co responding to a velocity of 2500 f. s., 36,837 foot tons; energy co responding to 2674 f. s., 42,144 f. t.; weight of gun, 50.35 tons.

Fig. 1.

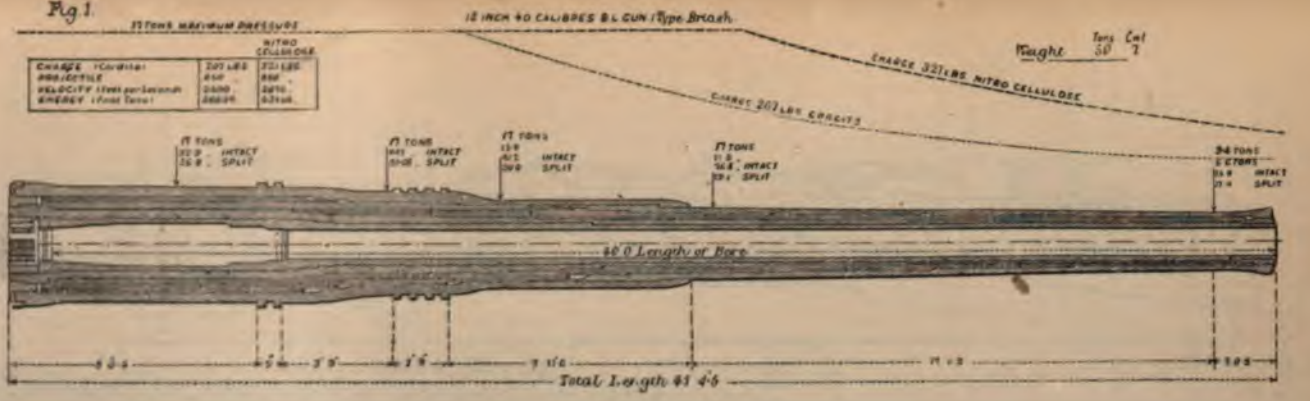
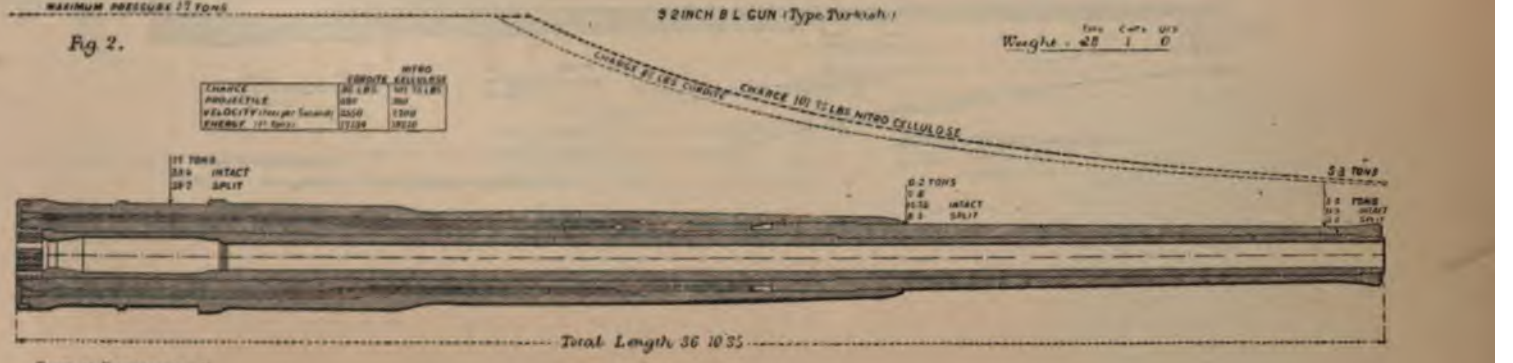


Fig. 2.



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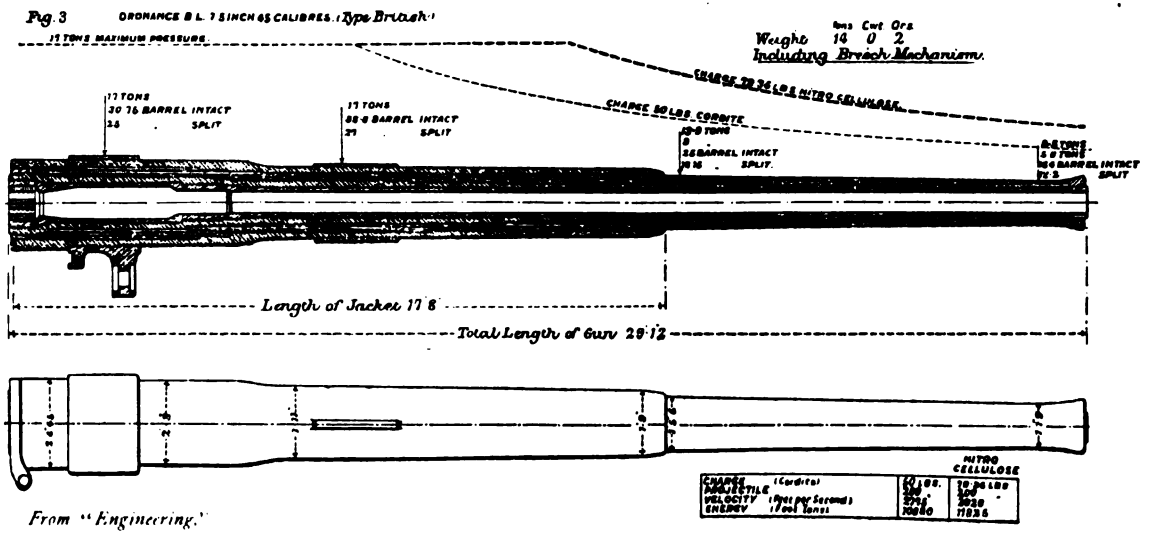

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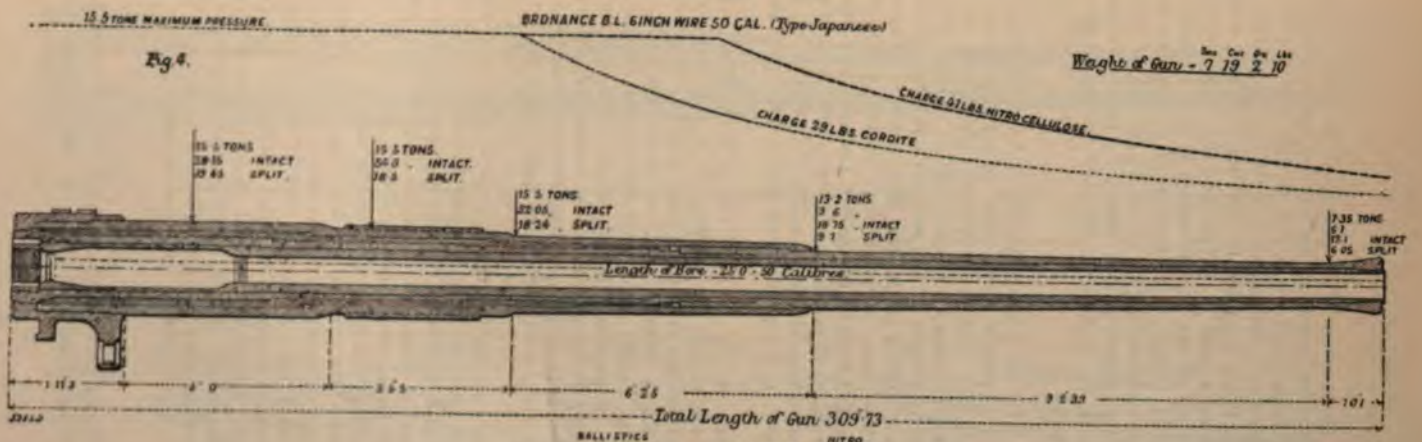


BALLISTICS

	CORDITE	NITRO CELLULOSE
WEIGHT OF PROJECTILE	100 LBS	100 LBS
WEIGHT OF CHARGE	28 "	61 "
MUZZLE VELOCITY (ft. Secs.)	2000	2000
MUZZLE ENERGY (ft. Tons)	6240	6240

From "Engineering."

Fig. 9a

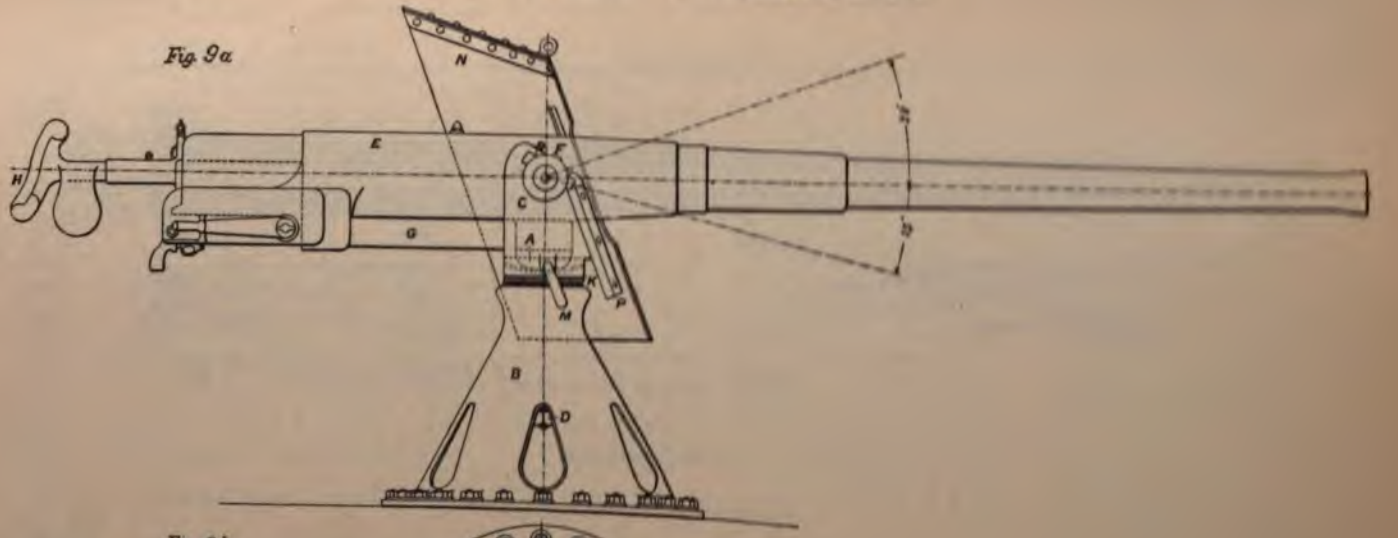
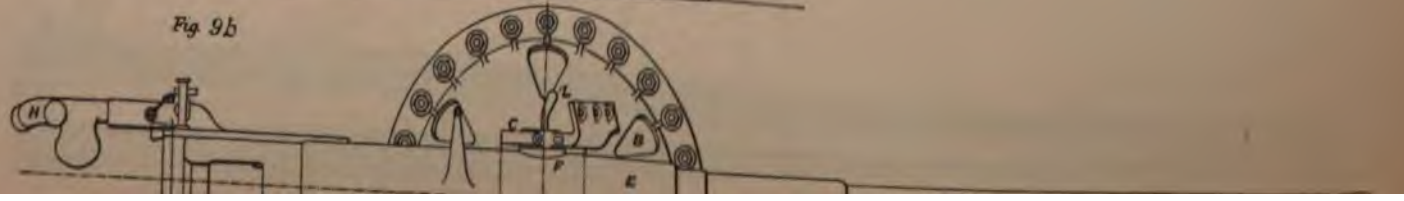


Fig. 9b



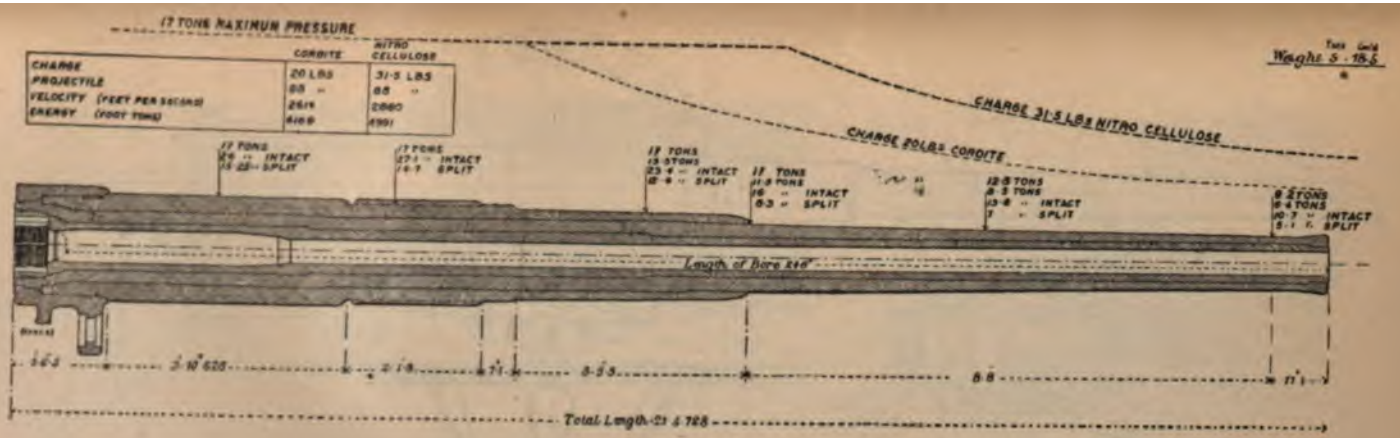
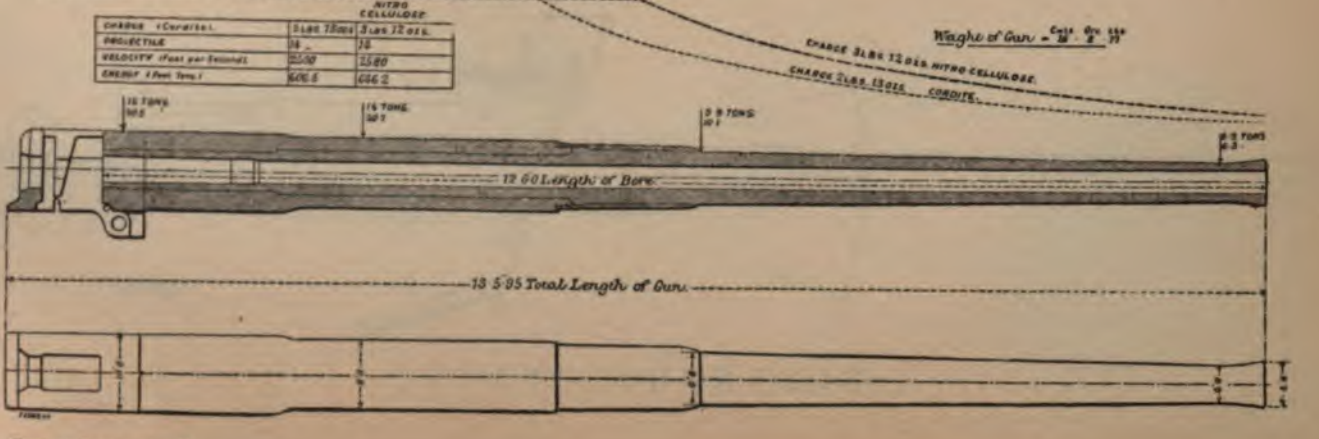


Fig. 6. 3 INCH (18 PDR) AUTOMATIC Q F GUN. (Type United States of America)
MAXIMUM PRESSURE 15 TONS. 50 CALIBRES.

	CORDITE	NITRO CELLULOSE
CHARGE (Cordite &c.)	3 Lbs 7 Ozs	3 Lbs 12 ozs.
PROJECTILE	18	18
VELOCITY (Feet per Second)	2000	2080
ENERGY (Foot Tons)	646·6	696·2



From "Engineering."

3-inch in having a Hotchkiss block instead of the Welin plug and modi
Fletcher mechanism. The mechanism is similar to that of the 6-poun
semi-automatic gun now in service. The particulars of the gun pro
are very similar to those of the 3-inch R. F. G. given in the table
PROCEEDINGS No. 99, page 555, but even where identical they are gi
here for convenience. Total length, 161.95 inches length of bore,
inches; weight of charge (navy smokeless, nitrocellulose), 5 poun
weight of projectile, 13 pounds; corresponding velocity, 2800 f. s.; c
responding energy, 709 f. t.; weight of gun, 0.9 ton.

The mounting (Fig. 9) consists of a top carriage A, which works
a steel cone-shaped pivot stand B, and has its upper part formed int
crosshead C. The cone is provided with gun-metal liners, and the pi
is secured to it by means of a pivot nut D. The cylindrical sleeve E,
which the gun is free to slide in recoiling, is supported by trunnion
in bearings formed in the arms of the top carriage; and it is provi
with two hydraulic cylinders G, in which work pistons attached to a
on the under side of the breech end of the gun. The elevating a
training are effected by means of a shoulder piece, H, attached to
sleeve. The top carriage is fitted with a clamping screw and a traversi
clamping segment which fits into a groove, K, in the liner. Wh
tightened by means of the handle, L, this segment secures the gun
any required position of train. A similar handle at M clamps the g
at the desired degree of elevation.

Protection is afforded the gunner by a shield, N, which is bolted
flanges, P, forged on the arms of the top carriage. The hydrau
cylinders are provided with tapered grooves, which allow the liquid
escape around the pistonheads, and so regulate the flow that a const
pressure is maintained during recoil. Inside the cylinders are stro
spiral springs surrounding the piston rods which, being compressed
the rearward motion of the pistonheads, return the gun to battery af
the recoil is checked.

The breech mechanism and semi-automatic gear are shown in Fig.
Under the rear end of the sleeve, A, is the pistol grip, B, which conta
the trigger, C, and on the right side is a detachable lever, D, by
movement of which the breech block, E, can be raised or lowered. T
breech block is capable of vertical movement and contains the ma
spring, F, the firing pin, G, the sear, H, and the cocking lever, I.
tween the hydraulic cylinders there is a powerful flat spring, K, wh
works the breech mechanism.

To prepare the gun for firing, the breech is opened by the moveme
of the hand lever, D, the handle of which is supported in a shallow crut
formed on the side of the sleeve. This lever turns the crank, M,
action of which brings down the breech block, E, and compresses t
flat spring, K. At the same time the main-spring, F, is compressed a
kept compressed by the sear, H. The breech block, in moving dov
strikes the lower extension, O, of the extractor and causes the upp
portion to move out from the face of the barrel and bring two sm
projections, P, over the upper edge, L, of the breech block, E, thus p
venting it from rising from the pressure of the spring, K. The c
tridge is pushed smartly into the bore and, as it goes forward into t
chamber, its rim strikes against the extractor and forces back the pr
jections, P, releasing the breech block which now rises, pressed up
the spring, K, which rotates the crank, M. The tail end, R, of the se

is now engaged with the toe, S, of the trigger, and by pulling the trigger, C, the sear is released and the firing pin, G, is thrown forward by the main-spring, F. This fires the cartridge and the gun recoils in its sleeve. The recoil, which is controlled by the hydraulic cylinders, compresses the counter-recoil springs, which return the gun to battery. As the gun returns, the action pawl, T, engages the hook, U, on the crank, M, and causes the crank to turn about its axis and thereby bring down the breech block. The extractor throws out the empty shell, first loosening it by a slow movement which increases rapidly enough to give it the necessary impetus to clear the breech. The action then proceeds as before.

VICKERS-MAXIM BREECH MECHANISM FOR 6-INCH GUN.—The breech mechanism shown in Figures 7a, 7b, 7c, 8a, and 8b is the new Vickers-Maxim design for 6-inch guns, and is used in our service on the 5-inch, 6-inch, 7-inch, and 8-inch quick-fire guns. The breech-plug is divided into six segments, four of which are threaded, so that two-thirds of the circumference is used to resist the powder pressure.

The link for actuating the breech-plug is pivoted to a pin, G, projecting from the breech-plug, B, at one end, and pivoted at the other end to a short crank, H, which is mounted on the carrier, D. Partly around the boss of this crank, H, are formed "skew gear" teeth, which gear with "skew" teeth formed around a sleeve keyed to the hand lever. A loading tray, I, is provided, which is automatically moved across the breech face of the gun, and at the same time raised into the loading position while opening the breech (or lowered when closing it).

The firing gear is arranged for firing by electricity or percussion, and is directly operated by the hand lever, A, so that the gun is absolutely safe against firing after the breech commences to open. For this purpose a nut, K, is fitted on the end of the mushroom stem, L. In this nut a vertical slide, M, which covers the end of the primer, N, is worked by means of two spring bolts. One of these bolts, O, engages with a cam, P, on the hand lever, A, the other, Q, in a groove, R, in the link of the breech mechanism. An ejector, S, actuated by the movement of the slide, is fitted in the nut. A spring-retaining catch is fitted in the end of the mushroom stem and prevents the primer from being jerked out, however violently the mechanism may be closed.

The motion is as follows: When the hand lever, A, of the breech mechanism, is swung away from the gun, the cam, P, forces the slide, M, downwards in the nut, K. As the hand lever, A, continues to swing away from the gun, it eventually loses its connection with the spring bolt, O, of the slide, M, and the downward movement of this slide is continued by the movement of the link, F, which actuates the other spring bolt, Q, and keeps the slide, M, in the correct relative position until the breech is closed. When the slide, M, has been moved down far enough, it actuates the ejector, S, thus jerking out the primer. On the first movement of the slide, M, downwards, and before the breech has commenced to unlock, the firing pin, C, is partly drawn back by means of the toe, with which it is provided, engaging with a quick incline on the rear of the firing gear nut. The spring bolts are arranged so that in the case of misfire the slide, M, may be pulled down by hand far enough to eject the primer and insert a new one, so that it is unnecessary to open the breech.

Fig. 7a.

BREECH MECHANISM FOR 6 INCH. 50 CALIBRES. Q.F. GUN. SCALE 1/2

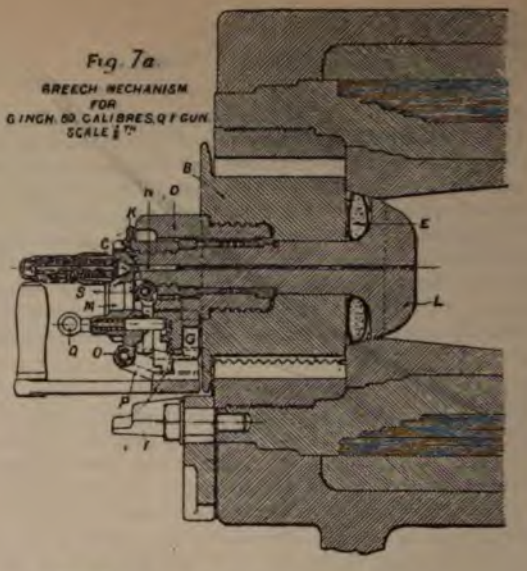


Fig 7b.

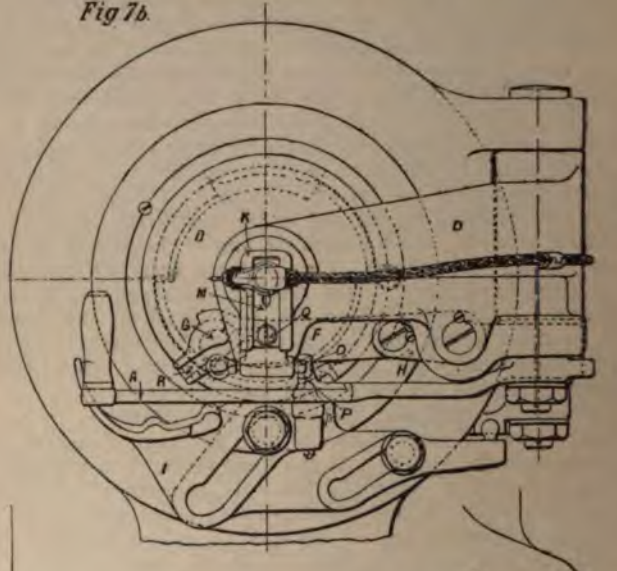
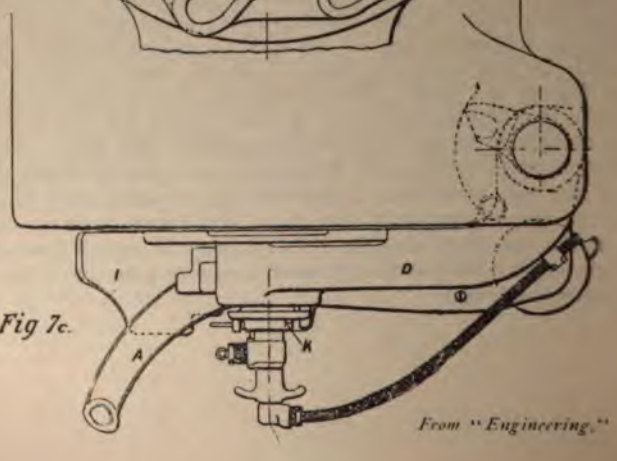


Fig 7c.



From "Engineering."

FIG. 8a.

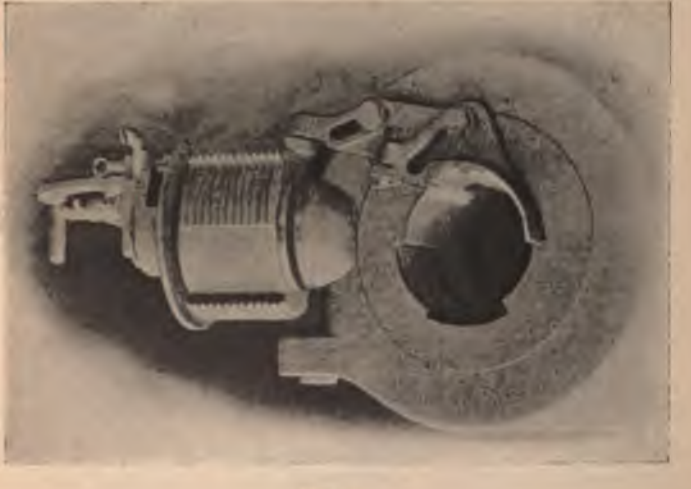
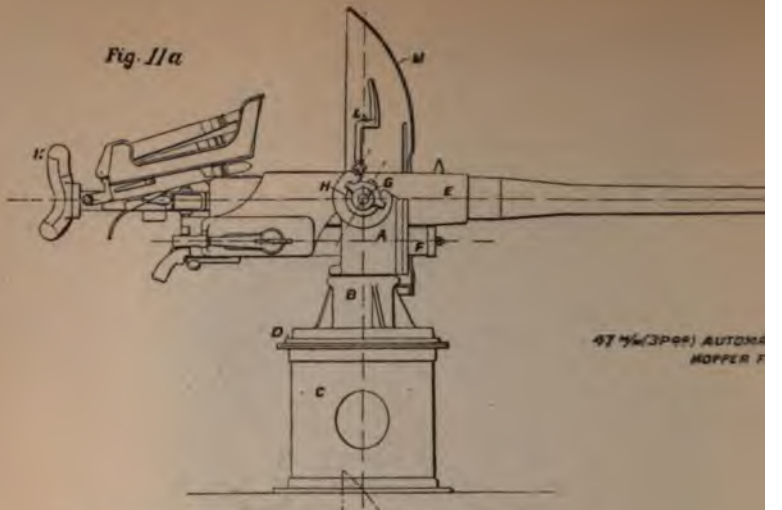


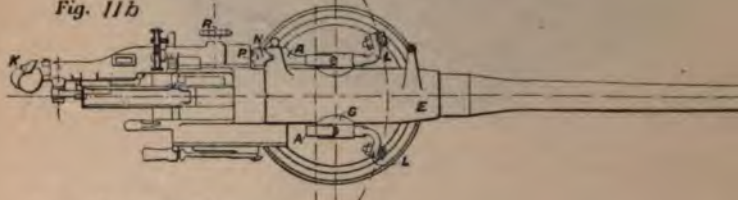
FIG. 8b.

Fig. 11a



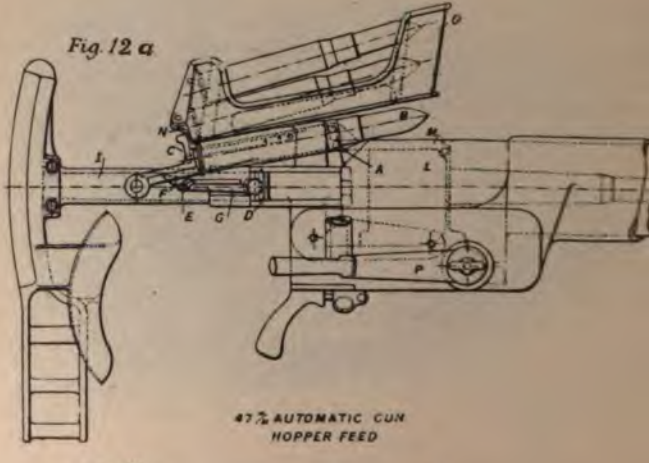
47 ¾(3P9P) AUTOMA
HOPPER F

Fig. 11b



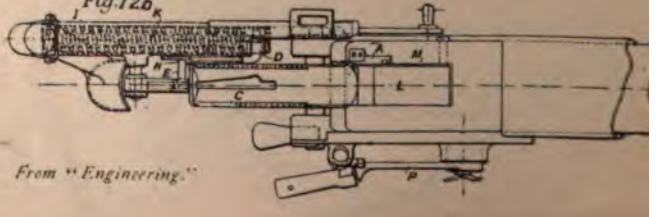
From "Engineering."

Fig. 12a



47 ¾ AUTOMATIC GUN
HOPPER FEED

Fig. 12b



From "Engineering."

THREE-POUNDER AUTOMATIC GUN.—This gun (Figs. 11 and 12) is now under trial for use in the United States Navy. It is made by the Vickers-Maxim Company, and has some features which make it superior to the semi-automatic type. It loads its own cartridge, so there is no danger of burring the face of the breech in loading, or deforming the cartridge by striking the shell, or failing to give the cartridge sufficient force to trip the extractor lugs which hold the breech block down. The automatic feature insures against accident resulting from opening the breech too soon after a hang-fire. This is a very real and serious danger with smokeless powder and must not be lost sight of. The gun and mount are shown in Figs. 11 and 12.

The mount consists of the usual top carriage, A, resting on a circular pivot stand, C, the stalk of the top carriage passing through the socket, B, being secured by a nut underneath. The socket, B, is secured to the lower part of the pivot stand by the holding-down ring, D. The sleeve, E, through which the gun recoils, is provided with a hydraulic cylinder in which works a piston attached to a lug on the gun. On the sleeve are forged the trunnions, G, which are supported in the trunnion seats, H, in the arms of the top carriage.

The elevating and training of the gun are effected by means of the shoulder-piece, K, which is attached to the sleeve. Attached to the top carriage is the elevating segment, N, grooved to receive the front end of the clamping bar, P, which is attached to the sleeve. This bar being tightened in the groove by means of the wheel, R, the gun is fixed at the required elevation. A training clamp is provided by a screw bolt which passes through the socket, B; the outer end is bent at right angles to form a lever. The shield, M, is bolted to the arms, LL, which are cast in one with the top carriage.

The hydraulic cylinder has grooves in its inner surface which allow the liquid to escape around the pistonhead and which so regulate the flow that a constant pressure is maintained during recoil. Inside the cylinder there is a strong spiral spring surrounding the pistonrod, which, being compressed during recoil, returns the gun to battery.

The hopper-feed mechanism is shown in Fig. 12. Its operation is as follows:

When the gun recoils it brings the carrier rest, A, under the lug, B, on the carrier, C, and does not leave it until the gun has returned to its firing position; the carrier, C, can therefore under no circumstances descend until the gun has returned to battery. During the recoil the face of the breech of the gun forces the plunger, D, with its pawl and feeder, E, back until the hook, F, on the pawl, G, passes the lug, H, on the shoulder-piece, I. The pawl is raised by its spring, K, and the hook, F, engages with the lug, H, thereby cocking the plunger piston, D. The gun returns, and at a certain distance before reaching battery, the action pawl, coming into play, opens the breech, and the ejection of the empty case begins.

When fully back to battery, the carrier, C, descends, being clear of the carrier support, A, and after being moved a certain distance it engages with the part of the pawl forming the feeder, E, depressing it, and finally disengaging the hook, F, from the lug, H, on the shoulder-piece, I.

The plunger piston spring, K, reacts and returns the plunger, D, with its pawl and feeder, E, to its original position, the feeder forcing the cartridge in the carrier forward, shooting it into the chamber.

The breech block, L, now rises and, during its ascent, raises the lifti lever, M, and through it the carrier, C. When this latter is nea home, it engages through the projection with the tail, N, of the escap ment, and moves it out of the path of the cartridge in the hopper. The cartridge, being thus liberated, slides through the hopper into t carrier, its place in the hopper being taken by the next cartridge, whi in turn is locked by the escapement as the carrier descends, and is lib ated on the return of the carrier.

When the breech is closed the gun is ready for firing, which is effect by pulling the trigger. By holding the trigger back the gun contin to load and fire without stopping.

NOTE.—The descriptions and plates of the guns described in the fo going notes (beginning with that of the British 12-inch piece) are d rived from an article on the "Development of Ordnance," by Lie A. T. Dawson (late R. N. and now a distinguished ordnance enginee read before the British Institution of Mechanical Engineers, and pu lished in *Engineering* (London). To this most excellent periodical t compiler of these notes is under constant obligation for informati concerning every branch of the naval profession.

KRUPP AUTOMATIC BREECH MECHANISM FOR LARGE GUNS.—The ope ation of the breech is effected by a gear wheel which engages in a ra moving with the gun, but not so rapidly. The gear wheel turns conveyer screw, operates the breech mechanism and opens the breec Apparently, from the description given, the breech is started open duri recoil, and not during the return of the gun to battery. The Briti patent bears date of June 29, 1901.

POZZUOLI-ARMSTRONG GUNS.—Fifteen or twenty years ago Mess Armstrong, Mitchell & Company (now Sir W. G. Armstrong, Whitwor & Company), established a factory at Pozzuoli, near Naples, Italy, for t manufacture of guns and ordnance material under their patents a designs, and the present Elswick Company still has an interest in t works, if it does not own them. There have been numerous rumors th many guns made at the Pozzuoli factory have proved seriously defectiv and the Kriegstechnische Zeitschrift (No. III, 1901) contains an artic upon the subject. In this article it is stated that in December last t question was brought up in the Italian parliament, where the charge w made that certain guns furnished to the Italian government by the Po zuoli factory were so weak that they would not stand a single full charg The Minister of Marine admitted that the guns referred to were defectiv but stated that the defects were to be made good by the Armstron Company. It was impossible to learn if the charges were based upo very recent work, but in the parliamentary (Italian) discussions of th past eight years it appears that there has been repeatedly manifested distrust of the material turned out by the Pozzuoli factory. The list o failures is a very long one. Those mentioned in the article are: 100-ton gun for the Doria, found defective; two 10-inch guns for th Cristobal Colon, rejected on account of defects; the guns of the Sa Martin had to be constructed in England, notwithstanding this entaile much delay, owing to strikes at Elswick; one 10-inch gun for the Jos Garibaldi failed; sixty-eight new guns for new Italian ships were re jected as unfit for service after trials, and had to be repaired or replaced

The failures seem to be due partly to poor material, but chiefly to poor workmanship.

AMERICAN MACHINERY FOR TURKISH ARSENALS.—It is reported from Constantinople that there is every reason to believe that an American syndicate is likely to secure the contract for the renewal of machinery in the Turkish arsenals. At the present time the existing plant, on which many hundreds of thousands of pounds have been spent, is practically valueless, having been allowed to rust and generally to fall into incurable disrepair. It is, in fact, scarcely worth its price as scrap-iron, with the added cost of removing it. Assuming that the American syndicate does actually receive a substantial order, its members will most probably be the sole beneficiaries. Knowing what we do of the Ottoman character, the assertion may with perfect safety be made that the efficiency of the Turkish arsenals will not be increased by any change of plant alone. What is first required is an alteration in the machinery of the Government.—*Arms & Explosives*, July, 1901.

PERSIAN ORDNANCE FACTORY.—The Russian press says that the quality of the work turned out at the gun factory at Teheran, Persia, under the superintendence of German officers, exceeds all expectations. Excellent reports have been given of twenty-three guns of various calibers. Machinery is expected from Germany by means of which 200,000 to 500,000 Mauser cartridges will be produced daily. Factories are also to be established shortly for the manufacture of side-arms. Ten Persian officers have been sent to Germany to be present at the experiments with new quick-firing Krupp guns, and two went to Havre to witness the firing of the Creusot guns.—*Army & Navy Journal*, July 20.

GARLAND AUTOMATIC 1-POUNDER.—Agents of the Russian government have been in treaty with Mr. Frank M. Garland, of New Haven, Conn., U. S. A., with regard to his invention of a quick-firing gun, especially designed for use in the fighting tops of war ships, which will fire 1 lb. projectiles at a rate of 208 per minute. The gun is said to be capable of keeping up this rate of fire, presumably with intervals, for 12 hours at a stretch, and if so, it is certainly a deadly weapon. Two Russian agents appear to have submitted it to searching tests, and to have reported favorably upon it, and they are now awaiting the confirmatory report of a third expert. Should his verdict agree with those already given, we understand that Russia will be prepared to purchase the entire plant, in which case it is probable that Mr. Garland will go to Russia to superintend the processes of manufacture.—*Arms & Explosives.*

ADAPTER FOR FIRING BLANK CARTRIDGES FROM AUTOMATIC MACHINE GUNS.—Mr. W. G. Hay, of Liverpool, England, has recently patented a device for firing blank cartridges for automatic machine guns whose mechanism is operated by the lateral escape of gas from the barrel. Applied to the muzzle is an adjustable stop by which the passage for issue of the combustion gases can be more or less throttled, so that they are for a time maintained at sufficient pressure to blow aside the lateral gas lever or operate the piston or plunger which works the lock mechanism. In order to render the blank cartridges suitable for being fed by the usual mechanism they may be elongated, but preferably there is put

in the mouth of each a hollow wooden plug of bullet shape. Th plugs, it is stated, as they meet the stop at the muzzle, are burst i small pieces by the gas pressure within them. The stop for the muz is preferably in the form of a set screw lodged in a socket which can screwed on the muzzle. Patent issued May 15, 1901.

GUNS: FIRING

NOTE.—Under this head will be given notes referring to firing tests of guns, tar practice, special practice, accidents to guns while firing, etc.

TESTS AND DESCRIPTIONS OF U. S. NAVAL GUNS.—The following scriptions and tests of U. S. Naval guns, 3-inch, 4-inch, 6-inch, and inch, are furnished by Lieutenant W. G. Turpin, U. S. N., recen assistant inspector of ordnance at Indian Head.

UNITED STATES NAVAL 12-INCH, 40-CALIBER GUN: TRIALS, AND R MARKS UPON GUN AND MOUNT.—This is the latest design of 12-inch gu and is designed to give 2800 f. s. with a chamber pressure of 17 to using a suitable smokeless powder. The principal advance over the old guns is the increased initial velocity and consequent increased energy the projectile. Two things produce these results, the increased leng of the bore and the increased size of the powder chamber, the latter which is most important.

The mount, like that of all recent guns, is of the spring-return ty having four recoil cylinders, each of which contains a set of springs return the gun to battery. The gun proper is without trunnions a recoils in the line of fire in a sleeve which carries the trunnions, elevati gear, and recoil cylinders.

The breech mechanism is an adaptation of the Fletcher-Farcot mecha ism to the Welin block. The stepped slotted screw, owing to great portion of the circumference (three-fourths in this gun) bearing, pe mits a shorter block and reduces the time of opening, as the necessa angle of rotation and length of translation (retraction) are both less.

The gas check is of the De Bauge type with split rings instead of disc The firing lock is of a new type (Mark VIII), in which the opening the lock automatically ejects the old primer; it is designed to use t combination primer. The elevating gear is of usual type for these gu and can be operated either by hand or power.

The following are the ballistic results of firing one sample of smokele powder, using the ordinary 850-pound projectile.

Round.	Charge, pounds.	Pressure, tons.	Muzzle velocity, f. s.
1	240	5.95	1913
2	280	9.35	2123
3	304	10.9	2344
4	328	13.0	2531
5	350	15.5	2770
6	360	16.5	2837
7	370	18.0	2885
8	376	20.5	2890

UNITED STATES NAVAL 6-INCH, 50-CALIBER GUN: TRIALS, AND REMARKS UPON GUN AND MOUNT.—This gun is similar to the 5-inch of the same length (see PROCEEDINGS No. 98, page 425). The breech mechanism is exactly the same. The piece is designed to give a velocity of 3000 f. s. with a pressure of 17 tons in the chamber. The velocity in service is fixed at 2900 f. s.

The mount is of the pedestal type, being somewhat modified from the earlier designs to withstand the increased energy of the gun. The latter is trunnionless, recoils in a sleeve and is returned to battery by springs. The recoil cylinders are two in number and are placed under the gun. The cartridge case has been discarded and the charge put up in a bag. The modified De Bauge type of gas check is used. The lock is arranged for electric or percussion firing and automatically ejects the old primer case when the breech is opened. In case of failure of the primer the gun can be cocked without opening the breech.

The elevating and training gears are of the usual type and are convenient to the gun firer, who stands on a platform revolving with the gun.

The following are some of the results of firing:

Round.	Charge, lbs.	Pressure, tons.	Muzzle velocity, f. s.
1	33	7.45	2141
2	36	8.9	2325
3	40	11.95	2577
4	44	14.5	2822
5	45	15.35	2848
6	46	16.15	2935
7	46.5	16.35	2955
Tests of another sample:			
1	30	7.8	2153
2	35	9.83	2365
3	40	12.4	2677
4	43	14.4	2821
5	44.5	15.3	2850
6	45	15.8	2932

UNITED STATES NAVAL 4-INCH, 50-CALIBER GUN: TRIALS, AND REMARKS UPON GUN AND MOUNT.—In this gun the brass cartridge case is retained and the projectile is made up in one with the powder. The powder is enlarged as in the other guns and this necessitates a bottle-shaped case. Like the other 50-caliber guns, this is designed for a velocity of 3000 f. s. with a chamber pressure of 17 tons, but the service velocity is fixed at 2900 f. s. The gun recoils in a sleeve and is returned to battery by springs in the two recoil cylinders, which are placed underneath the sleeve. The mount is of the pedestal type. The breech mechanism is the modified Fletcher-Farcot and operates a Welin breech plug, which has two blanks and four threads. The plug is carried in a collar, but does not have to be retracted before the breech is open, but is swung directly out as soon as unlocked. The extractor is carried on the front end of the block in a manner somewhat similar to that of the Dashiell. Electric or percussion firing can be used, the change being made by shifting a small catch. The primers in the cartridge cases are

all of the combination type. The following are some of the ball results obtained with this gun, using a 32-pound shell:

Round.	Charge, lbs.	Pressure, tons.	Muzzle velocity f. s.
1	12	9.1	2200
2	14	12.8	2586
3	15	14.35	2761
4	15.5	15.9	2891
5	16	16.4	2943
With another lot of powder:			
1	10	4.65	1831
2	13	8.1	2343
3	15	12.1	2751
4	15.5	14.3	2899
5	16	17.4	3039
With third lot of powder:			
1	10	6.3	1893
2	12	8.7	2201
3	13	10.3	2363
4	15	13.3	2717
5	15.5	14.2	2805
6	16.1	15.15	2903
With fourth lot of powder:			
1	12	9.7	2315
2	14	13.0	2657
3	15	16.0	2922
4	15.5	16.3	2972
5	15.75	16.7	3003
With fifth lot of powder:			
1	14	13.0	2668
2	15.5	16.4	2982
3	15.75	18.2	3079
With sixth lot of powder:			
1	15	16.6	2931
2	15	16.3	2898
3	15.5	17.6	3046
4	16	19.0	3155
5	16.15	20.2	3204

All these results are good, except, perhaps, the first, which was a li too slow burning for the gun. The second and fifth samples gave cellent results as regards both pressure and velocity. The last sam showed a high ballistic efficiency per pound but the pressures were hi

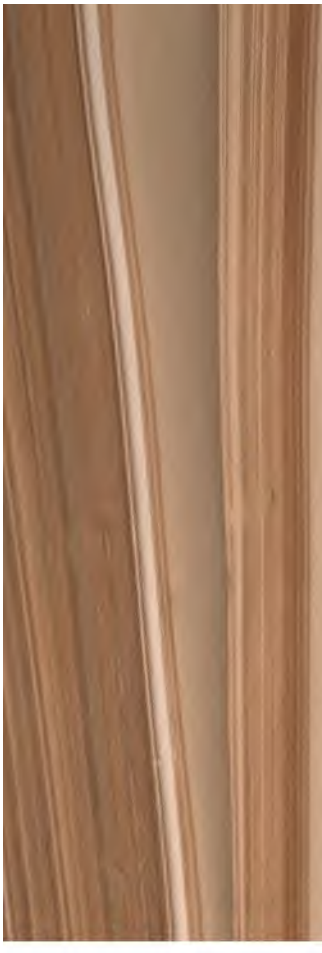
UNITED STATES NAVAL 3-INCH, 50-CALIBER GUN: TRIALS, AND F MARKS UPON GUN AND MOUNT.—This gun, like the 4-inch, has a bott shaped brass cartridge case with the charge and projectile in one. L all of the 50-caliber guns, it is designed to develop 3000 f. s. velocity w

7 tons pressure in the chamber. The service velocity is fixed at 2800 f. s. The gun recoils in a sleeve. The recoil cylinders, two in number, are placed under the gun and contain the liquid and counter-recoil springs. The breech mechanism differs somewhat from that of the larger guns as the step system is not used. The plug has no motion of translation to the rear, but is swung out as soon as unlocked. This is effected by cutting away in the arc of a circle the blanks of both plug and screw box, which are farthest from the hinge of the plug. This latter is not carried in a collar but its rear end is held in a plate which closes the breech, and is hinged like the usual plug collar. The later types have a catch to prevent the rebound of the plate when closing the breech. The plug is rotated by means of a small rack sliding in the breech plate, resembling that in the Dashiell mechanism. The firing mechanism is for percussion, and the lock can be cocked when the breech is closed. The case is not ejected entirely by the extractor; that is, it is not violently thrown out—it may be fully ejected if the gun is slightly elevated. The gun is trained and elevated by mechanism, as it was found to be too heavy for training and elevating with a shoulder piece. No rapidity tests were made, but it can be loaded and fired much more rapidly than is consistent with accurate firing. The endurance of these guns seems to be ample. Several have been fired a large number of times. One has been fired 376 times with high velocities and pressures—the latter ranging from 13 to 19 tons—and it shows no signs of wear or erosion. The following are some of the ballistic results attained with the service 13-pound projectile:

Round.	Charge, lbs.	Pressure, tons.	Muzzle velocity, f. s.
1	4	9.6	2337
2	4.5	13.0	2710
3	5	14.75	2841
4	5.1	15.4	2915
5	5.2	16.3	2942
With another sample of powder:			
1	4	8.7	2109
2	4.5	10.75	2331
3	4.75	11.9	2470
4	5	13.0	2590
5	5.2	13.65	2656
6	5.4	14.7	2778
7	5.6	16.55	2858
With a third lot of powder:			
1	4.75	11.9	2534
2	5	14.8	2796
3	5.1	14.8	2824
4	5.2	15.8	2870
5	5.3	16.5	2902

Of these samples the first was much the best.

UNITED STATES NAVAL 7-INCH GUN: TEST.—According to newspaper reports, this gun has, within a few days, had a very satisfactory test. With a projectile of 170 pounds (165?) the muzzle velocity was over 3000 feet, the chamber pressure being 17 tons. The designed service velocity is 2900 f. s.



BROWN 10-INCH WIREWOUND GUN: BR
TION OF GUN.—This gun, which was recentl
ninth round while under test at Sandy Hook
The jacket yielded near the forward end o
containing the breech plug being driven to
it struck and wrecked a concrete structure
lay several unmounted mortars. The sho
broke in two the ring of the jacket which
is an excellent commentary on the characte
breech block and bushing surrounding it
Mr. J. N. Brown and Mr. H. M. Munsell,
attribute the giving way of the jacket to the
check, whereby the whole forward surface of
was exposed to the powder presence. Th
A properly constructed De Bauge gas check
acts better and obturates more perfectly wit
a low one; one that fails must be very p
ordinary failure to obturate perfectly would
fast enough to create a high pressure behin
likely cause of failure was that the cast-stee
strength. Cast steel is very uncertain in i
resist very sudden stress is not to be mea
accurate enough with forged metal. The bel
pulled off the jacket shows it must have bee
tenacity, or it ought not to have broken w
For twenty years cast steel has been discard
is hard to understand why the designers
jeopardize their work by using it. It is by th
considered features that many otherwise go
While the compiler is opposed to all systems
present condition of gunpowder developme
addition to the transverse strength of the pie
wirewinding the longitudinal stiffness is seriou
tudinal stiffness is necessary to insure accuracy
of the lateral vibrations in the long guns of th

So far as can be judged from theoretical co
as far as shown, the Brown gun is probably
piece. If the segments can be so closely fit
elastic strength into play, the discontinuity o

tended to furnish a section of the gun in the notes for this number of the PROCEEDINGS, but the drawing was accidentally omitted. It consists of a thin tube surrounded by a segmented body. Over this is wound several layers of wire. Over the wire a thin casing of steel covers the chase and a jacket, with its front end reaching over the rear end of the casing, extends far enough beyond the breech face of the tube to form a housing for a breech ring, or bushing, in which is formed the screw box. The segmental core for the 5-inch gun (and it is similar for the 10-inch) consists of eighteen sheets of steel 19 feet long, 24 inches wide at one end, 6 inches at the other, and one-seventh of an inch thick. The manner of combining them may best be illustrated as follows: Imagine sheets of elastic cardboard of these proportions (say one-twelfth of the dimensions given) laid in a pile so that the edge of each is set back slightly from the edge of the one beneath it. Hold the sheets so that they will not slide upon each other and roll them up into a slightly conical tube about half an inch in inside diameter. If the sheets were properly placed before rolling, the outer edges of the cardboard will show at equal distances around the circumference. Now smooth out the interior of the tube by smoothing down the edges of the cardboard until the interior is a perfect cylinder. In the actual gun the sheets are put together in this way but are shaped before being assembled. After the segments are in place, numerous clamps are put on to hold them together and the tube inserted by hydraulic pressure. The wire is then wound on with a tension of 2600 pounds, but as the cross-section is small this is equal to a stress of 128,000 pounds per square inch. The end of the wire is secured by means of a metal plug in a hole in the first shoulder of the muzzle ring, thence to the breech and back to the muzzle again. The second layer begins at the second shoulder and is similarly wound as are the remaining layers. The chase jacket is then forced on by hydraulic power and a threaded muzzle cap or ring screwed on. The jacket is then shrunk on, the lining tube bored and rifled, and the breech bushing fitted and slotted to receive the breech plug.

GATHMANN GUN TEST: FAILURE TO ACHIEVE RESULTS EXPECTED BY INVENTOR.—Strictly speaking, this was a projectile test; but as it involved the whole Gathmann system, including gun, powder, and projectile, it has been placed under the head of GUNS: FIRING. Only newspaper accounts of the test are as yet available. And many interesting points are not touched upon. The inventor claimed that the gun would develop a muzzle velocity of 2100 foot seconds with only 20,000 pounds maximum chamber pressure. This the compiler regarded as absurd. The newspaper accounts do not give the velocity attained but say that the muzzle energy was 40,000 foot tons. This would mean a muzzle velocity of about 1800 f. s., which is probably all the gun is capable of safely developing.

The target was a steel armor plate supported by the same sort of structure as is found behind it in ships. In rear of this, and bracing it to receive the blow, were heavy pieces of timber driven deeply into the earth, and in rear of this again a heavy sand butt. The plate was of Krupp face-hardened steel, made at the Carnegie armor factory, and its dimensions were: 16 feet by 7.5 feet by 11.5 inches. The weight of the Gathmann shell was 1860 pounds. Its probable striking velocity, a little less than 1800 f. s. In the first trial, November 15, the projectile struck

Mr. Gathmann admitted that the results
but thinks they warrant further experim
a battleship which was struck the shock
her out of action. In this he is certainly
ing of the plate into several pieces wo
of action.

BRITISH 12-INCH GUNS: SPEED OF FI
12-inch guns on the new British battlesh
fired from two guns in 4 minutes 46 sec
guns in 2 minutes 24 seconds. In all
guns.

BRITISH 9.2-INCH GUNS: SPEED OF
of the 9.2-inch guns of the Aboukir, five
in 85 seconds. The weight of the proje
the cordite charge 52 pounds.

FATAL ACCIDENT WITH 6-INCH GUN
terrible accident took place on board the
eign on November 9, by which Captain S
were killed, one other man possibly fat
and thirteen men less severely injured. T
been caused by the protrusion of the fir
plate that it struck the primer with suffi
breech plug was forced home and before it

BELLEISLE: PREPARATIONS FOR NEW T
Belleisle has been refitted for further t
Krupp steel 4 inches thick and 20 feet lo
and similar plate 6 inches thick on the
by the gunboat Pincher, of 265 tons, whi
a 9.2-inch gun and several smaller piece
be of long duration and the results will
every shot the Belleisle will be visited and

TARGET PRACTICE IINSTRUCTIONS, BR
instructions have been issued by the A

during each run. All heavy guns that will bear are to fire on each run, but not light quick-firing and machine guns. The firing basis is not to be marked by buoys, and the distances of the target are to be found and given to the guns by the methods which would be available in war time. One ship is to mark for the other, and only actual hits are to be counted. No ship is to carry out this exercise that has not completed a quarter's practice since commissioning. An annual report of the results obtained by these long distance practices is to be made to the Admiralty.' "—*Army and Navy Journal.*

BEST TARGET RECORDS IN BRITISH NAVY IN 1899, 1900, 1901.—The best scores in the British navy for the last three years are: 1899, Scylla, 46 per cent of hits with 6-inch gun, 80 per cent with 4.7-inch gun; 1900, Terrible, 60 per cent with 9.2-inch guns, 77 per cent with 6-inch guns; 1901, Terrible, 64 per cent with 9.2-inch guns, 80 per cent with 6-inch guns. Lieutenant M. Woollcombe, gunnery lieutenant of the Terrible, in his report on the recent prize firing, says: "The shooting and loading of the after 9.2-inch are worthy of notice; in six minutes this gun fired 12 rounds and hit the target 9 times, which is 1.5 hits per minute. This is more than the fleet average for 6-inch Q. F. guns."—London *Times.*

RECENT TARGET PRACTICE IN BRITISH NAVY.—"The much greater interest that is being displayed in the Navy in the matter of good shooting is bearing fruit and is one of the most gratifying signs of the times. Admirable records have been made by the Terrible and Barfleur in China, while in the Mediterranean Sir John Fisher's officers have accomplished excellent things. Thus the Isis made considerably over 30 per cent of ascertained hits with her 6-inch guns before going out to China and the other records of the ships were extremely good. Now it is reported from China that the Ocean, in firing 110 rounds from her 6-inch guns, has made an average of over 52 per cent. It is, of course, very desirable that such results should be carefully verified, and that the splash of the shell should not be counted as a hit. We do not for a moment suggest that this has been done, but where high records are made it is very desirable that they should be completely authoritative. It is certain that good practice is now being made at ranges never before dreamt of, at any rate for real fighting, and evidently, if even 10 per cent of hits can be made at 5000 yards and 5 per cent at 7000 yards, it would be worth while, in a chase, to open fire at the latter range, and very possibly at the opening of a regular engagement. Some slight doubt has been suggested as to 30 per cent of hits having been made at a target supposed to represent a cruiser at 5000 yards, but it is well ascertained that this percentage has been exceeded in the Mediterranean, and the fact that 80 per cent of hits has been obtained by the Terrible strongly disposes us to look for very high averages, and the 52 per cent of the Ocean, though highly gratifying, is not perhaps surprising. The Terrible's results were phenomenal, but the Prince George last year made a record of 55.9 per cent, while in 1899 the Scylla had 46 per cent of hits with 6-inch guns and 80 per cent with 4.7-inch guns. The progress made is most gratifying and is admirable testimony of the efforts made by the officers."—*Army and Navy Gazette*, London, September 7.

TARGET PRACTICE IN FRENCH NAVY: OLD TORPEDO BOAT AS TARGET.—"The French Mediterranean Squadron has been engaged in its quar-

between 2000 and 3000 metres. Unfortun
boat went to the bottom. It is not kno
the direct blow of a shell or to damage ca
Army & Navy Gazette, London, Septembe

IMPROVED SPEED OF FIRING OF FREN
34-centimeter turret guns of the Valmy h
new system of loading designed by M. Guy
coloniale. The former speed of fire was
With the new apparatus the speed is slig
minute. Starting with the guns loaded, fi
four minutes.

NEW AUSTRIAN FIELD GUNS.—"Accor
trials of the new wrought-bronze field gun
into the Austrian Army, have proved very s
which were conducted under conditions cl
of actual service, the trial batteries develo
which are now in process of being remedie
being made. At the same time, it is in co
the Ehrhardt quick-firing gun, first indepen
by side with batteries of the bronze gun
which model shall be adopted will be made
Veszprim, in Hungary, which will take plac
some time in September."—*Arms & Explosi*

COMPETITIVE TRIALS OF FIELD GUNS AT S
field guns now going on will probably con
after January 1, when the guns will be sen
with these guns are likely to continue, ther
May. Two foreign guns are being experime
and the Ordnance guns. The total weight
approximate 3950 pounds, and the weight o
15 pounds. A muzzle velocity of 1700-1750 f
sure not to exceed 33,000 pounds per square
of a known and satisfactory composition.
the expense of the Government. Minor de
delay, may be corrected, but no change of
Special attention is given to the mechanism

cleaning and lubricating them, and the length of trail and weight on trail in limbering. The calculations by which the strength of various parts was determined will be verified.

There will be tests with defective ammunition, and the dust and rust tests. Ten rounds will be fired with excessive pressures, two each with 35,000, 38,000, 40,000, 42,000, and 44,000.

When metallic ammunition is used, ten rounds will be immersed in water for five minutes, and then allowed to stand twenty-four hours before firing. Additional rounds will be subjected to a humidity test at a temperature of 100 degrees F., and relative humidity of 95 degrees for thirty days and then fired. Each limber with chest completely filled will be mounted on a vibrating table and be subjected to the jarring thereon for forty-eight hours, to see if the serviceability has been affected. It will also be subjected to the moisture test. Limber chests will be exposed to the weather for two weeks, and then examined and part of the contents fired.

In testing the guns for accuracy 50 shots will be fired, if necessary, at a 2500-yard target from clay or loam platform. Each gun will be subjected to four tests for rapidity. 1. Rapidly unaimed shots from loam platform, 10 rounds, the trail having been set by one shot. 2. Rapidity with accuracy from clay platform, 10 shell and 10 shrapnel at 2500 yards, the trail having been seated and range secured by not exceeding two sighting shots. 3. Same from macadam road or rock platform. 4. Maintained rapidity; forty-five aimed shots from clay platform. During this test the target will be twice changed; the targets being so placed that the trails will have to be shifted. These tests for accuracy and rapidity will be made at Fort Riley. Fifteen rounds will be fired in the general tests from clay, loam, sand, rock, and macadam platforms, five each at extreme and zero elevations, and extreme depression, an equal number of shots being with the gun at extreme position right and left, and in mean position. In these tests the jump, departure from line of fire, and depth of trail and wheels will be noted. When necessary to move the trail the power and time required will be noted. In addition, twenty rounds will be fired with trail rigidly supported by an oak post set into the ground and braced to prevent yielding. Carriages having recoil on the ground will, in rapidity tests, be limited to 40 feet, and the ground will be broken up to assimilate actual conditions. These guns and carriages which have not failed in the above will be subjected to a practice march of 150 miles, following country roads as much as possible. Careful examination will be made of the equipment en route and at the end of the march. Such additional rounds will be fired over and above those mentioned as may be deemed necessary to establish any point arising, and such additional tests will be conducted as may for any reason seem necessary to the Board of Ordnance and Fortification."—*Army and Navy Journal*, November 16.

GUNS: MOUNTS

UNITED STATES NAVY: NEW 12-INCH MOUNT.—In his annual report, Admiral O'Neil, Chief of Ordnance, U. S. Navy, says: "Plans have been prepared for a new type of mount for the 12-inch, 40-caliber guns, in which there are but two recoil cylinders, located under the gun, the

said to be some improvements, but the method of loading the magazine and its position remain unchanged.

KRAG MAGAZINE: CYLINDRICAL TYPE.—Mr. C. H. J. Krag (Norway) has recently taken out a British patent for a cylindrical magazine. From the sketches published it is hard to see why the piece does not break in two at the magazine, as there seems to be very little to hold it together at this point.

BRITISH SERVICE RIFLE: DEFECTS, ETC.—"A somewhat curious memorandum has been issued by the Commander-in-Chief. It appears that considerable trouble—which is a mild way of putting it—has been caused during the war, more particularly with regard to the Imperial Yeomanry and other volunteer troops, by the loss of breech-bolts from the Lee-Enfield rifle. Those who are well acquainted with the .303 Service arm are aware that it is by no means perfect, and stories have long been current as to the necessity for securing the breech mechanism from unpremeditated opening by the use of a boot-lace or other contrivance. This tendency, however, is common to practically all bolt-actions, especially when the rubbing surfaces become a little worn, and it does not necessarily affect either the safe handling or the general efficiency of the weapon when in use. But there is a grave difference between this mere shaking open of the breech and the absolute freeing of the bolt from its shoe. In the one case, there will probably be the loss of one cartridge, and some little confusion in bringing the rifle up for firing, caused by the necessity for putting the bolt into position; in the other case, the weapon is entirely useless. From the existence of a necessity to draw attention to this contingency, it is evident that the stop-spring and hook on the bolt head, which are supposed in the Lee-Enfield to prevent the complete retraction of the bolt, do not stand the test of ordinary Service conditions. They are, in fact, not sufficiently strong to do the work required of them. It is no sufficient remedy for this state of affairs that the memorandum in question draws attention to the existence of a safety stud which will lock the bolt in position, and further points out that for the future the cost of replacing lost breech-bolts will fall more or less directly on the men who handle the weapons. It is to be hoped that this detail, among many others, is receiving attention from the experts who are engaged on the not impossible task of improving still further our essentially patchwork Service small-arm."—*Arms & Explosives*, October, 1901.

NEW GERMAN RIFLE, MODEL '98; TESTS OF AUTOMATIC RIFLES.—"It will be remembered that we gave, a few months ago, an illustrated description of the new Mauser rifle, 98, which has been adopted for use in the German army, and we understand that the manufacture of this arm is being proceeded with in due course. The German military authorities, however, do not appear to regard this improved magazine rifle as representing finality, for we learn that they are now subjecting various types of automatic rifles to a series of exhaustive tests at Spandau. For the present, while several kinds are being experimented with, no definite decision has been made, so that the re-arming of the troops with the new Mauser will continue pending further developments."—*Arms & Explosives*, September, 1901.

which resembles that of operating a double action revolver. Starting with the pistol discharged the first part of the pull of the trigger revolves the bolt; then the bolt is retracted, the empty case expelled, a new cartridge (pushed upward by a spring) slips into place ahead of the bolt, the bolt moves forward, loads the fresh cartridge and fires it. To continue the operation, it is then necessary to release the trigger. After it has gone forward again, pulling upon it causes the operations described to be reproduced.

A Chinese Infantry Rifle of Mammoth Size.—The following account is translated from the *Rivista di Artiglieria e Genio:* "On account of its curious character we reproduce from the *France Militaire* of August 12 the following data of a gun with which the infantry of the Celestial Empire is to be armed, and which is the heaviest and most inconvenient piece at present known.

"This arm which, according to the paper mentioned, would be adopted after the Chinese troubles were over, is made at the Shanghai arsenal and is nearly a copy of the German Mauser, Bodel 1888, but on a scale almost three times as large.

"The caliber is 15 millimeters (0.59 inches); the length without bayonet is 2.55 meters (8.36 feet); the weight is over 20 kilograms (44 pounds). In order to handle a piece so unusual in character, three soldiers are required instead of one—two to hold it on their right shoulders in a horizontal position and the third to fire it.

"The range is equal to that of a small cannon, being 4000 meters (4373 yards). The cylindro-ogival bullet is like an artillery projectile, is of steel, and weighs 100 grams (0.22 of a pound); the muzzle velocity reaches 700 meters (2297 feet)."

Chinese Arsenals.—"Mr. Gerow D. Brill, who was until recently in the employ of the Chinese Government, states the Chinese have arsenals and smokeless powder factories at Foochow, Hanyang, Nanking, Chengtu, and near Canton. At Hanyang there are factories working at full pressure, night and day, turning out hundreds of magazine rifles, and they have also all the machinery and metal for making large ordnance, quick-firing, and machine guns. There is also a factory there for the production of smokeless powder, and this is now in full work. The same informant expresses it as his opinion that Chang-chi-tung is one of the wisest men in the country, and that he is not making arms and ammunition for nothing, nor reorganizing the army without some definite object. He concludes an interview by saying, 'No one can tell what is going to happen in China.'"—*Army and Navy Journal*, October 5.

Small Arm Factory at Calcutta.—"It is practically certain, says a *Times* telegram, that a rifle factory will be established on the good site available for a gunpowder factory at Ishapur, near Calcutta. The establishment of such a factory, capable of producing 25,000 rifles annually, would greatly increase the defensive strength of India, particularly as the work of the cordite factory in the Nilgeris is proceeding rapidly. India, in a few years, will be self-supporting as regards all war material except guns for artillery purposes. The manufacture of steel shells has proved a complete success."—*Engineer* (London), June 28.

TORPEDOES

DOES FOR U. S. NAVY: REPORT OF CHIEF OF BUREAU OF ...—The following is derived from the annual report of the Bureau of Ordnance, U. S. Navy:

...se of torpedoes on large vessels has practically been dis-..., no provision having been made for them in the latest battle-... cruisers, and the torpedo armaments of the Olympia and San ... have been removed.

...y-nine Whitehead torpedoes, Mark II, 5 meter, 45 centimeter, ... manufactured, and have successfully passed the required tests. ...do of this lot has been fitted with a device for superheating the ... air, which upon experiment has been found to be of value.

...ew gyroscopic steering gears for use in torpedoes have been ...e has given good results. A feature of this new device is ... be so adjusted that after the torpedo has been launched the ...ll turn in the water through a predetermined horizontal angle, ...ke up a straight course. Further experiments are in progress. ...sky steering gear, adapted to a Whitehead torpedo is in ...construction, and will soon be ready for trial.

...merged tubes, of the Elswick-Whitworth type, for the Maine, ...nd Ohio, are in process of construction at the naval gun ...

...trically driven air compressor has been completed and tested. ...ons are 75 by 56 by 34 inches over all. Its weight is 5000 ... motor weighing over 3000 pounds, the machine and base ...mething less than 2000 pounds. The motor is shunt wound, ...evolutions per minute, and develops 25 horsepower with an ...nt.

...s installed on the Morris, at the torpedo station, an experi-...do electric firing apparatus. After tests with this, it is now ...ed on all torpedo boats and torpedo-boat destroyers.

...paratus has a keyboard which can be manipulated by the ... officer while he is conning the vessel. From this keyboard ...rtain when the torpedo tubes are loaded and primed. By ...he can fire at will any torpedo or all torpedoes at once from ...at the conn.

...ce, used in connection with the adjustable gyroscopic steer-...viously referred to, will enable the torpedo vessel to fire ... simultaneously at one target, for after entering the water ...s will all pursue a predetermined course in the direction of ... arranged for by the adjustment of the gyroscopic steering ... train of the torpedo launching tube."

...TER TUBES IN BRITISH NAVY.—"After an experience ex-... fifteen years, the Admiralty have decided that, with the ...f the stern tube, all above-water torpedo tubes in battleships ... are useless, and the earliest opportunity is to be taken of ...them. As this decision affects every ship in the Channel ...e annual refit of those ships will take considerably longer ...n usual."—*Engineer*, London, October 25.

LEAVITT AIR-HEATING APPARATUS FOR TORPEDOES.—Mr. F. M Leavitt, of Brooklyn, has taken out patents for heating the compre air used in Whitehead torpedoes. In order to prevent refriger troubles, and to increase the efficiency of the air charge in White torpedoes, the air is heated near its point of exit from the flask by burning of a supply of alcohol, whose flow is held in check and contr by the pressure of air existing in the flask. The compressed air is to enter an air space in the spirit receptacle, so that when the tor is set in motion the reduction of air pressure in the flask allows pressure of the air in the spirit receptacle to preponderate and so f the spirit through an open tube into a vessel near the air passage, w it burns after being kindled by a fuse ignited on the release of the pedo. The British patent is dated April 24, 1901.

ORLING-ARMSTRONG TORPEDO "ACTINAUT."—This torpedo is oper by wireless currents. It differs from the Varicas torpedo (PROCEED No. 97, page 207) in some respects, but the general principle involve apparently the same. No good description of the details of the pedo have yet appeared. It has been under development for se years, and about two years ago it was reported to have had succe trials before the king of Sweden. The following note appeared in *Army and Navy Journal* of November 16:

"Experiments with the Orling-Armstrong system for the transmis of power without wires have been witnessed at Hughden by the N attachés of Germany, Austria and the United States. To this torp which is steered by invisible radiation, the name of 'Actinaut' has l given. Captain Coerber, of the Imperial German Navy, was chose his colleagues to manipulate the apparatus at a distance of 1300 y from the torpedo, while Captain von Schwartz and Commander Clo of the Austrian and American Services, approached the trench in wh the actinaut floated, in order to observe the movements of the rudde port or starboard, according to the operator's will. It could, however held in three positions only—hard aport, hard astarboard, and amidsh The inventors claim that a simple mechanical contrivance will enable rudder to remain five, ten, or fifteen degrees to port or starboard the movements of the target may require. An electric lamp enables operator to keep the torpedo in view at night, while a contrivance expelling a jet of water into the air, on the principle of a whale's bl hole, marks the position of the 'actinaut' by day."

DE LUCA—WHITEHEAD TORPEDO TUBES.—A new model torpedo t to which this name is applied, was tried on board the torpedo sch ship Trinacria at Spezia, Italy, on August 9, 19, and 20. The *I Militare e Marina* says that the trials were very successful and vessels of the Italian navy will hereafter be fitted with tubes on system.

BOOK REVIEWS.

Smokeless Powder, Nitrocellulose, and Theory of the Cellulose Molecule. By JOHN B. BERNADOU, Lieutenant, U. S. Navy. New York: John Wiley & Sons; London: Chapman & Hall, Limited.

This book is the most important recent contribution to our knowledge of smokeless powders of the nitrocellulose type and of nitrocellulose in general. All ordnance matters are progressing so rapidly that it is with difficulty that the most studious officer can keep up with all new developments, and in no branch of ordnance is the difficulty more pronounced as in that of explosives. Much is being published on the subject; but a great deal of it is made up by the papers of inventors, written for the purpose of exploiting their wares; some appears in disconnected fragments in government and scientific societies' reports; and some in the general literature of chemistry. But there is no very late work in which this information is gathered and treated from the ordnance standpoint. It is therefore with the greatest satisfaction and interest that we receive Lieutenant Bernadou's work. He has not, of course, covered all the ground desirable, for we need a great deal of information from the proving ground and the testing laboratory. But he has taken up one branch of the subject—the chemical—and treated it in a most satisfactory manner. As to the author's views in regard to the structure of the cellulose molecule, the reviewer is not a competent judge. Only a few chemists, experts in this particular line of investigation, could pass upon the question. There are some facts in apparent opposition to the theory advanced, but it is quite possible that they can be shown to be in agreement. The author's discoveries that nitrocellulose dissolves in ethyl ether alone under the influence of intense cold, and that at similar temperatures all celluloses, with the apparent exception of the highly nitrated insoluble variety, dissolve in ethyl alcohol, are most important, as one of the troubles connected with the manufacture of stable, non-friable nitrocellulose gunpowder is the difficulty of drying the colloid containing a considerable percentage of water and alcohol without rendering the grains so brittle that they are liable to break up in the gun and so cause irregular—and perhaps dangerous—pressures. Such discoveries as these lead us to believe that in developing a purely nitrocellulose powder we are following the right path, and to hope that we shall in time produce a nearly ideal propellant.

The appendices, which form something more than half the book, are not less valuable than the main text. Their distinguished authors are so widely known that a review is needless to convey a knowledge of their importance, and the title in each case is a sufficient indication of the contents. The first is a tranlation by Lieutenant Bernadou of M. Vielle's "Researches upon the Nitration of Cotton"; the second is Lieutenant Bernadou's translation from the Russian of Professor D. Mendéléef's

paper on "Pyrocollodion Smokeless Powder"; the third, a tranlatio a paper by M. Bruley on the "Nitration of Cotton"; while the fo is a lecture delivered by Lieutenant Bernadou before the Naval College in 1897.

L. S. V. I

Bulletin de L'Association Technique Maritime, 1900.

This very valuable publication contains a mass of matter too ex sive and diverse in character to be properly reviewed in a limited sp and only a few words can be said on the papers read before the A ciation. The first is one by M. Bertin, Director of Naval Construct on the Stability of a Steamer after Collision (and injury). The o papers are:

a. Note on an Application of the Theory of Stability at small An of Inclination; by M. Van Meerten. This is very brief.

b. Note on a new Calculating Machine; by M. Bonnet.

c. Resistance of Ships; Effect of a Change in any Dimension; by Rota (Italian Navy).

d. Practical Formulas; by M. Afanassief.

e. Contribution to the Theory of the Screw Propeller; by M. Rat

f. Screw Propellers; by M. Stephane Drzewiecki. This is a very tensive paper on a subject of which we know entirely too little.

g. On a Rational System of Units in questions of Naval Constructi by M. Hauser (Chief Constructor, retired).

h. Standardizing of Results of Calculations; by Prof. Biles of Glas University.

i. The Future Fusions: Armored Cruisers, cruiser-destroyers, Submarine Boats; by Colonel Cuniberti (Chief Constructor, Italian Na These are the three types towards which Colonel Cuniberti think naval construction is tending. This is a very interesting paper, but cannot quite accept all the distinguished author's conclusions.

j. The Fighting Ship of the Future; by Mr. F. C. Goodall, M. I. N. and A. C. Holzapfel. These gentlemen propose a ship 600 feet lc 100 feet beam, 28 feet draft, displacement 31,000 tons. This ship cc be very perfectly protected and very powerfully armed.

k. Note on Tonnage Laws; by Mr. Isakson (Lloyds Inspector).

l. Tests of a Belleville Boiler; by M. Dugé de Bernonville.

m. Study of Boilers; by M. Montupet. This is a study of the M tupet Boiler, and is profusely illustrated.

n. Comparative Measures of Vibration on the German Cruisers Ha and Vineta; by Herr G. Berling (Constructor, German Navy).

o. Vibrations of Steamers; by Herr Otto Schlick.

p. Propulsion of Ships by Discs, etc.; by Captain Garin (Spar Navy).

q. Fatigue of Boiler Tubes; by M. Simonot. This is a long paper c taining some data and an extensive theoretical investigation of subject.

r. Note on the subject of a River Boat with Multiple Screws; by Ch. Doyère (Chief Constructor).

s. Protection of Hulls of Ships against the Torpedo and the Ram, the possible Change of Form and Proportions to Assure this Prot tion; by M. E. E. Goulaieff (Russian Navy).

t. Memoirs on a New Type of Ship that does not Pitch or Roll and is Uncapsizable and Insubmergible; by M. Turc (Lieutenant, French Navy).

u. Construction of Petroleum Vapor Vessels in Sweden; by M. Hugo G. Hammar (Constructor, Swedish Navy).

v. Light Ships and Inspection Steamers of the United States Light House Service; by Mr. W. T. Sylven.

w. Electric Plant in the Lisbon Arsenal and on the Cruiser Rainha Donna Amelia; by M. Croneau (Chief Constructor, Portuguese Navy).

x. Notes on Refloating of Ships; by Mr. D. W. Noakes.

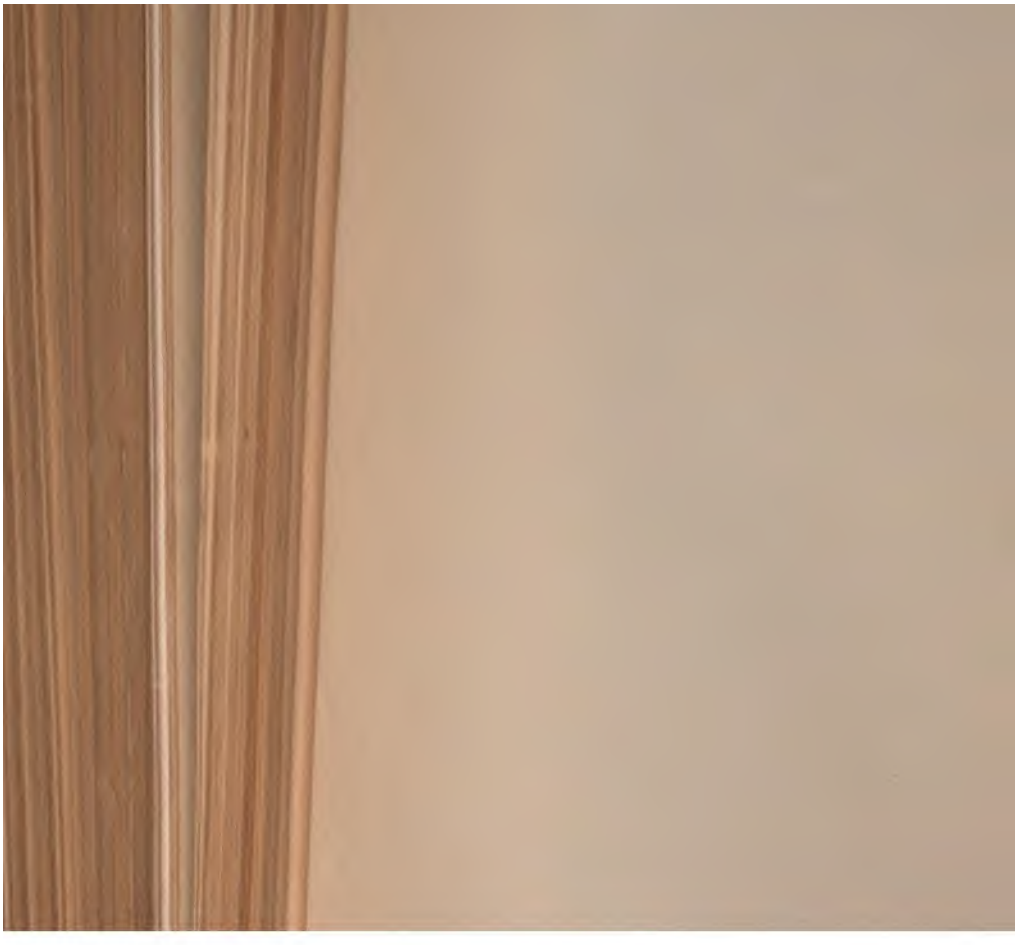
y. The Floating Dock as a Naval Auxiliary; by Mr. Lionel Clark, M. I. N. A. This paper contains several points of great interest.

z. Steel Hawsers for Towing and Gear for Operating Them; by M. Moissenet (Chief Engineer, French Navy).

aa. Water Screens; by M. Dibos. The water screen consists of a series of jets of water which can be interposed between a fireman and the steam rushing from a bursted tube or other fitting from which steam is escaping.

bb. Naval Architecture Considered from a Business Point of View and from that of its Effect on Commerce; by Mr. T. V. S. Angier.

cc. Description of the Works of the Newport News Shipbuilding and Dry Dock Company; by Mr. M. S. Chace.



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OCTOBER 25. Protected Twin-screw Torpedo-boats Siroco and Mistral. Gyroscopic Action and the Loss of the Cobra. The Vibration of Engines. Gas Engine Research.

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SPECIAL NOTICE.

NAVAL INSTITUTE PRIZE ESSAY, 1901.

A prize of one hundred dollars, with a gold medal, is offered by t
Naval Institute for the best essay presented on any subject pertaini
to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Contr
voting by ballot and without knowledge of the names of the competito

2. Each competitor to send his essay in a sealed envelope to the Se
retary and Treasurer on or before January 1, 1902. The name of the wri
shall not be given in this envelope, but instead thereof a motto. Accor
panying the essay a separate sealed envelope will be sent to the Secreta
and Treasurer, with the motto on the outside and writer's name a
motto inside. This envelope is not to be opened until after the decisi
of the Board.

3. The successful essay to be published in the Proceedings of the I
stitute; and the essays of other competitors, receiving honorable mentio
to be published also, at the discretion of the Board of Control; and
change shall be made in the text of any competitive essay, published
the Proceedings of the Institute, after it leaves the hands of the Boar

4. Any essay not having received honorable mention, may be pu
lished also, at the discretion of the Board of Control, but only with t
consent of the author.

5. The essay is limited to fifty (50) printed pages of the Proceedings
the Institute.

6. All essays submitted must be either type-written or copied in
clear and legible hand.

7. The successful competitor will be made a Life Member of the Inst
tute. If the essayist second in order of merit receive "Honorable Me
tion," he will also be made a life member.

8. In the event of the Prize being awarded to the winner of a previo
year, a gold clasp, suitably engraved, will be given in lieu of a go
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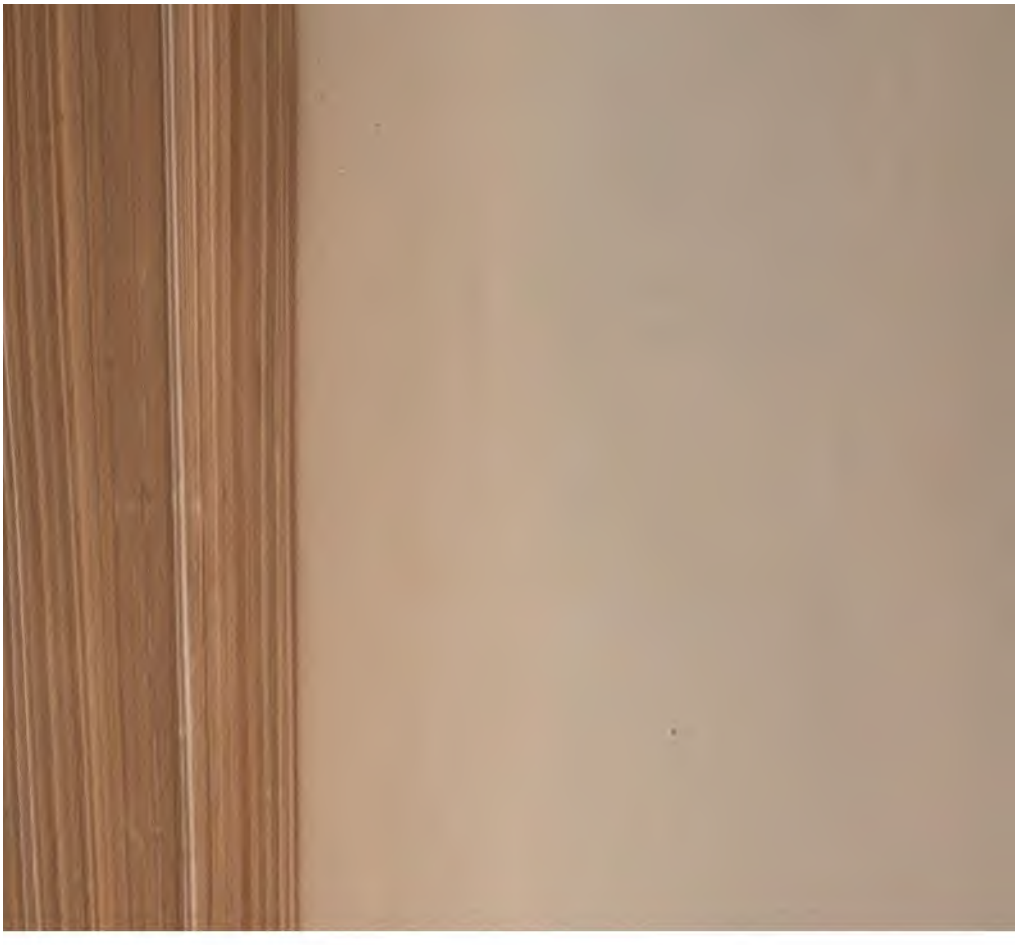

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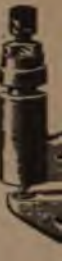

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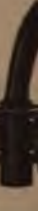

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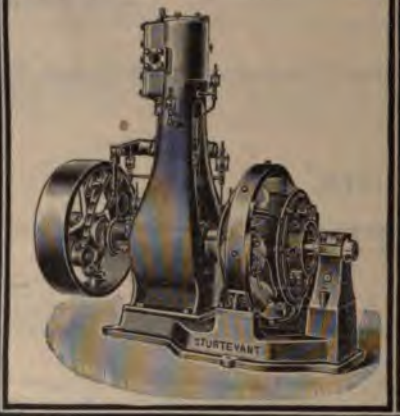

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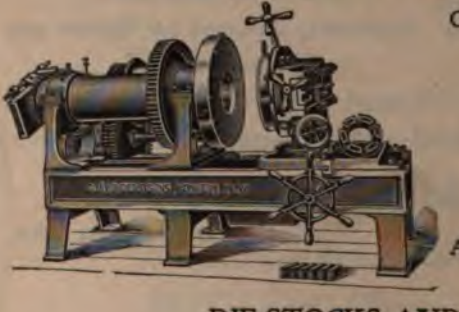

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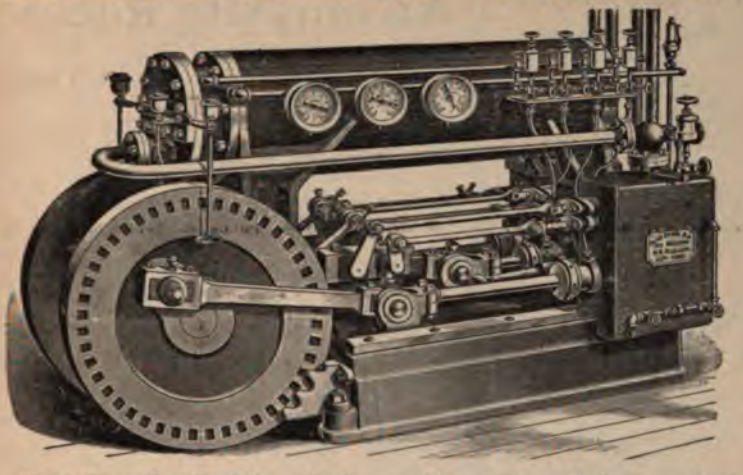

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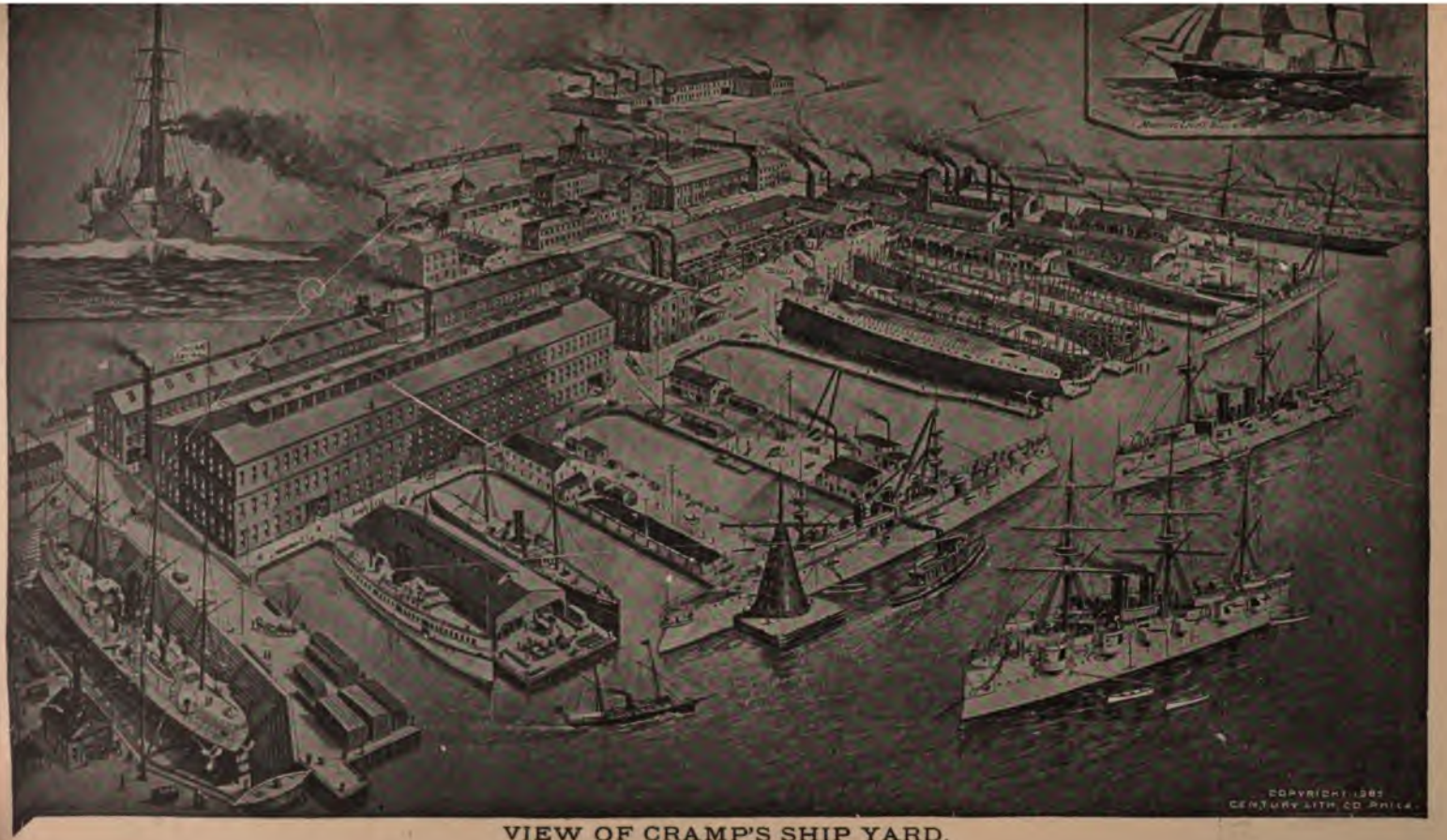

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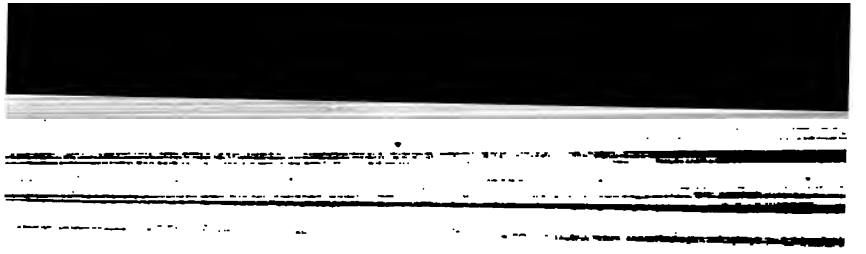

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